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Generation Transmission and Application of Electricity

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Workmen's Compensation Act

Considerable interest and speculation attaches to the development which will follow the enforcement of the Ontario Workmen's Compensation Act on the 1st of January. The act as it stands undoubtedly throws too much responsibility on the employer and too little on the employee, but the wide latitude allowed the Commission in their interpretation will, it is believed, result in decisions based rather on an appeal to common sense and justice than on the written law. As experience is gained the act will no doubt be amended and adjusted so that, as far as possible, neither party shall be placed at a disadvantage.

We can look forward with all the more confidence to the ultimate satisfactory working out of this scheme when we consider the methods of our neighbors to the south. Workmen's compensation legislation, sometimes compulsory, sometimes optional, has been tried in various states and in various forms. Some of them have been excessively burdensome on the employer as our own act threatens to be, but it is evident that, as experience is gained, an arrangement in the main acceptable to both parties is being evolved. At the present time twenty-four states of the Union have laws regulating compensation to workmen. An interesting article discussing the conditions in the United States from a legal man's point of view, is printed in a recent issue of the General Electric Review and on account of the present interest in this subject, is reproduced elsewhere in this issue.

One of the chief objections to our own act as already pointed out on these pages, is that practically all the responsibility is laid on the shoulders of the employer. Instead of encouraging the employee to be self-reliant and self-responsible, the act makes him more of a machine even than the trade unions have already made him. Instead of encouraging him to be careful by making him responsible for his carelessness—which responsibility would decrease in exact ratio with his caution—he is actually offered a premium for carelessness, which some men, possibly not the best, may even not hesitate to take advantage of to revenge themselves on an employer or organization against whom they may feel aggrieved. The act is particularly weak in that it makes a parasite, rather than a "man," of an employee.

On the other hand, the employer will be assured a certain measure of protection from the frequent unreasonable awards of our juries which (without wishing to imply partiality) do generally decide that the more wealthy party is at fault. Our jurors in the past few years appear to have become saturated with the idea that so long as their verdict is against the party who can afford to pay the penalty, they cannot be far wrong. The necessity for the exercise of sound judgment or respect for legal rights only becomes necessary where the contending parties are matched financially. Against these evils the compensation act will in a measure protect capital.

Another and very desirable result of the act, from everybody's point of view, will undoubtedly be that the average employer will be driven to take more personal interest in the conditions under which his men work—in short, he will become an enthusiastic supporter of the "Safety First" movement. This in itself is very desirable. It will lead to the installation of protective equipment, the rehabilitation of old-fashioned lighting systems and, in general, an improvement in the conditions under which the workmen operate. This will be reflected in both the quality and quantity of the work performed and will go a long way towards balancing the expenditure this act will incur.

Considered impartially the new act appears to possess possibilities for great improvements in the relationship between master and man, mutually beneficial to both. As already stated, the results will be watched with the keenest interest, intensified all the more by the very large percentage of our population affected.

Canadian Coal Production

The Department of Mines has just issued its report covering the calendar year 1913 on the production of coal and coke in Canada, compiled by Mr. John McLeish, B.A., chief of the Division of Mineral Resources and Statistics. The total production of coal was 15,012,178 short tons, made up as follows:—Nova Scotia, 53.15 per cent.; Alberta, 26.75 per cent.; British Columbia, 18.08 per cent; Saskatchewan, 1.42 per cent.; New Brunswick, .47 per cent.; Yukon Territory, .13 per cent. The character of the coal mined in Canada is chiefly bituminous and lignite, although there is an output of anthracite approximating 200,000 tons per annum from a mine at Bankhead, in Alberta. The total consumption of coal in Canada during 1913 was 31,582,545 tons or 4.07 tons per capita, as compared with 3.59 tons per capita in 1912. This leaves 18,201,953 tons imported in 1913, as compared with 14,595,810 tons imported in 1912. The greater part of this coal comes from Pennsylvania and Ohio. The importation was made up of anthracite, 4,642,057 tons; bituminous run of mine, 10,743,473 tons, and bituminous slack, 2,816,423 tons. The imports of both anthracite and bituminous run of mine have more than doubled since 1906, while the imports of bituminous dust have increased over threefold during the same period.

The report gives interesting figures regarding the increase in the coal production industry in the last forty years. In 1874 the total production was 1,063,742 tons, which has gradually, and fairly uniformly, increased to a little over

15,000,000. During this same period, the average value per ton has increased from $1.66 to $2.49 per ton.

The total quantity of coke manufactured in Canada during 1913 from both domestic and imported coal was 1,517,133 tons. The quantity of coal used in this manufacture was 2,247,913 tons, made up of 1,698,912 tons of domestic and 549,001 tons imported. In addition to the Canadian coke production there were also imported for home consumption 723,906 tons of coke.

Ontario Municipal Electric Association

The Ontario Municipal Electric Association was convened in Toronto on December 10th for the discussion of matters more or less of an electrical nature. Among other things discussed was the proposed subsidy to the hydro radials, and it was decided to send a request to the Dominion Government that the hydro radials should receive the same subsidy that is usually granted to privately owned railways. The executive was also instructed to investigate the subject of municipally owned telephone systems with provincially administered long distance lines. The subject of appointing a paid secretary for the purpose of perfecting the organization of the association, preparing for conventions, etc., was discussed and referred to the incoming executive. The following officers were elected:—President, Philip Pocock, Chairman Electric Commissioners, London, Ont.; 1st vice-president, Samuel Carter, M.P.P., Guelph, Ont.; 2nd vice-president, A. D. Bowlby, Chairman Electric Commissioners, Windsor, Ont.; Executive, E. I. Sifton, Esq., Hamilton; A. K. Sanderson, Esq., St. Thomas; W. S. Dakin, Esq., Galt; Geo. Lippert, Esq., Berlin; R. G. Black, Esq., Toronto.

Mr. E. M. Ashworth, secretary and assistant general manager of the Toronto Hydro-electric System, consented to continue to act in the capacity of secretary temporarily and until such time as a permanent secretary could be obtained.

Toronto's New Rates

The Toronto Hydro-electric Commission have announced their new rates for the year 1915. The figures show that a readjustment rather than a reduction has been the consideration of the Toronto Commission. The scheme of charging is not radically different from that adopted by the other Ontario municipalities, though in certain details the rating differs. Like the rest of the Ontario Hydro rates particular advantages accrue to the domestic customer whose consumption is large, as, for example, where electric ranges are in general use. Very little change is made in the power charges, and street lighting is kept entirely separate and will be based on the year's actual results, which will probably mean a small reduction per unit. The domestic and commercial rates are as follows:

Residences

Area Charge.—To be graded as follows on the basis of [illegible] cents per 100 square feet of floor area. First 400 square feet rated in full, next 600 square feet rated at [illegible], next 1,000 square feet rated at 800, next 1,000 square feet rated at [illegible], remainder rated at 50 per cent.

Meter Charge.—The first [illegible] kw. hours per 100 square feet of chargeable floor area per month at the rate of [illegible] per kw. hour, and the balance at [illegible] per kw. hour.

Discount 10 per cent for prompt payment.

Commercial Lighting

The first [illegible] hours' use of installed capacity or maximum demand at the rate of [illegible] cents per kw. hour, next [illegible] hours' use of installed capacity at three cents per kw. hour, all excess one and a half cents, subject to 10 per cent discount.

Light and Power Companies Honor Tried Officials

At a recent meeting of the directors of the Ottawa Light, Heat and Power Company, Limited, the usual quarterly dividend of two per cent. was declared, payable on January 1 to shareholders of record the 20th day of December. At this meeting Col. D. R. Street, secretary-treasurer of the company, and Mr. F. W. Fee, assistant secretary-treasurer, were both elected directors to fill the vacancies which have existed since the death of the late Mr. John Manuel and the late Mr. Honore Robillard.

At a meeting of the board of directors of the Ottawa Electric Company, Mr. A. A. Dion, general superintendent of the company, was elected a director to fill the vacancy caused by the death of the late Mr. Honore Robillard. Mr. Dion as general superintendent of the Ottawa Gas Company was also elected a director of that company. As Mr. Dion is an old officer of both companies, his appointment to the board should prove of value to his co-directors and of direct interest to the shareholders.

The action of the directors in honoring their old and trusted officers by appointment to the board is one that commends itself strongly in business practice.

No Change in Plans

The publicity committee of the International Engineering Congress, have sent out the following notice:—

"Some confusion seems to have arisen in the minds of at least certain of the engineers of this country, between the International Electrical Congress, which it was proposed to hold in San Francisco in September, 1915, and the International Engineering Congress, which is to be held during the same month.

"Owing to the unfortunate situation existing abroad, and the impossibility of convening the International Electrotechnical Commission, under whose authorization the Electrical Congress was to have been held, it has been decided by the governing body of the American Institute of Electrical Engineers to indefinitely postpone the holding of the Electrical Congress. This does not affect the International Engineering Congress, which goes ahead as originally planned.

"Marked progress is being made in connection with the latter, and papers have already been received from several of the foreign countries, and everything points to a successful issue.

"The Committee of Management of the Congress wishes to impress upon all engineers of the country its earnest desire for the support of the whole engineering fraternity, and feels that the volumes which will be received by those who subscribe to the Congress will be a very adequate return for the subscription fee."

Dominion Charter Includes Provincial

The recent decision of the Privy Council in the case of the John Deere Plow Company v. Duck, and Wharton v. The John Deere Plow Company, clears up to a very great extent, a number of uncertainties which have surrounded the matter of Dominion and Provincial Companies' licenses ever since Confederation. The chief result of the decision is the establishing of the paramount jurisdiction of the Dominion over trade and commerce, making it definitely clear that a company which has secured a Dominion charter may carry on business in the various provinces of Canada without the necessity of taking out anything in the form of a Provincial Charter. Manufacturers and other commercial companies operating in Canada who are well advised will as a result henceforth take out Dominion charters and ignore Provincial licensing acts. In order to understand the situation clearly

it is necessary to refer briefly to the cases upon which judgment has been given by the Privy Council.

The John Deere Plow Company was incorporated under a Dominion charter, with head office in Winnipeg, and authorized to carry on business in agricultural implements throughout Canada. The case of the Company v. Duck was an action for breach of contract to accept delivery of certain implements Duck had ordered but afterwards refused to take, alleging that the Company, having no license in British Columbia, could not proceed against him. The Company claimed that its Dominion charter was all that was necessary to enable it to carry on business in any province. The case of Wharton was a friendly action asking for injunction to restrain the Company from carrying on business in British Columbia on the ground that such business would be illegal because the Company had no Provincial license. Both cases were tried in the Supreme Court of British Columbia and decided against the company. Appeal was then taken to the Privy Council.

The judgment is very sweeping and declares that the clauses of the British Columbia act under consideration are invalid because they interfere with the powers conferred on the company by the Dominion Parliament, and with the company's status in the courts. The judgment applies equally to the extra-Provincial licensing and registration acts in Ontario, Manitoba, Alberta, Saskatchewan, New Brunswick, Nova Scotia and the Yukon. The act of the province of Quebec specifically excepts Dominion companies and is therefore unaffected. The act of Prince Edward Island is of a different character and is also unaffected.

Briefly, therefore, the situation is as follows:—

To do business throughout Canada a Dominion charter alone is necessary.

A Provincial license enables a company to do business in the province from which the license is obtained. Whether a Provincial license enables a company to do business outside of the province issuing the license is still unsettled, and is under consideration in connection with a case shortly to come before the Privy Council.

A province can no longer compel a company with a Dominion charter to obtain a Provincial license or to be registered in the province as conditions of exercising its powers or of suing in the courts.

The rights of the provinces to enact laws affecting the general public in the provinces and relating to civil rights, or taxation, or administration of justice are not affected.

The opinion of the Privy Council is definitely asserted in the following reference to the provisions of the British Columbia Companies' Act which were under discussion:— "Their Lordships think the legislation in question really strikes at the capacities which are natural and logical consequences of incorporation by the Dominion Government of companies with other than Provincial objects."

Condition of Blood After Shock

A request was recently received by the Accident Prevention Committee of the N. E. L. A. from a member company asking for information as to the condition of the blood after a person has received an electric shock.

The history of the case which prompted this request is as follows: The deceased had been leaning against an electric light pole connected with a four-ampere magnetite arc lamp with the series wiring only on the pole, when he suddenly fell over and died. A test of the pole and chain made the following night under the same climatic and atmospheric conditions showed no indication of ground, and it was believed that the man died of heart failure. A witness at the coroner's investigation testified that he had seen a flash and that death was caused by electric shock. The evidence produced at the inquest, based upon a post mortem examination, showed that a clot of blood had been found in the man's heart, but there were no indications on the body of burns or marks.

The Accident Prevention Committee submitted the matter to a number of qualified physicians connected with other member companies and subsequently received data which it is believed will be of interest. The data thus obtained is published in the N. E. L. A. Bulletin as follows:

"There are pin-point puncture burns discoverable where the current enters and leaves the body. The absence of all such burns is presumptive evidence that electric current does not figure in this sudden death in any dangerous quantity. The flash observed by the witness is something for the electrical engineers to explain."

Blood Will Not Clot

"The electric current destroys the coagulability of the blood. Blood will not clot when death is caused by electric current, according to the best evidence available. Dr. Edward Anthony Spitzka, of Philadelphia, says: 'The blood is profoundly altered biochemically. It is of a dark brownish hue, and it rarely coagulates. Either the fibrinogen, or the fibrin element, or both, are destroyed.' "

"The existence of a blood clot in the heart would controvert the theory of the man's electrocution, in fact, the mere presence of blood in the heart would indicate death to be due to some cause other than electrocution. His blood clot in the heart existed prior to any 'shock,' I would say. He may have gotten enough 'juice' to scare him, it would be conceded, perhaps, but the leaning on the lamp post was surely the occasion, not the cause of his death."

"In this surmise, the character of the clot would be the determining element. Was the clot white or red? Of what blood elements was it composed? White clots are composed of fibrin chiefly, and form slowly, are weeks in growth, and death comes quickly. Of clots that form in the heart, some occur post mortem. Did the clot contain bacteria? Any intercurrent disease or contributing septic condition?

"It can be said, however, that the electrolytic action of the current produces such biochemic changes in the blood plasma that the blood of the victim of electrocution will not clot within nor outside of the body."

"The anatomical changes in so far as the internal organs are concerned in death from this cause may be very slight. Essentially they are such as are characteristic of death from asphyxia. They include fluidity of the blood, general acute passive congestion, petechial hemorrhages of the serous membranes, and, rarely, more extensive hemorrhages into structures lying within the direct path of the current. To these changes may be added those resulting from the generating of intense heat which occasionally are seen in capital cases in the cervical portion of the spinal cord and in the oblongata. Gross anatomical lesions in the form of rupture of the myocardium have been observed by Spitzka, who has had a very large experience in capital cases in the State of New York.

Importance of Prompt Action

"It is believed that in a large portion of the cases in which death results from electric shock, notably those of accidental character, the anatomical injury wrought is so slight that if by any means physiological activity of the central nervous system and of the heart could be restored, life would be continued.

"It is also believed that a mechanical appliance adapted to instituting respiration under conditions approximating as closely as may be the natural, ought to prove very effective in resuscitating persons whose vital functions have been suspended in consequence of accidental electric shock. As already indicated, anatomical injury of internal organs is apparently so slight, and in making this statement I do not

overlook certain histological changes in the brain and spinal cord, which have been recognized as resulting from the passage of electricity through the body, that I am of the opinion that in cases where heart action still persists, if respiratory paralysis resulting from electric shock can be overcome by mechanical means, the stricken person ought to be capable of permanent resuscitation.

"This is a matter of very great interest and importance and any appliance or method for restoring persons apparently dead from electric shock seems deserving of critical investigation alike by physicians, physiologists and electrical workers."

"There is no doubt that currents of comparatively low intensity and having large surface contact areas with persons in circuit, may produce severe contraction of the heart muscle, and capillary hemorrhages, without having any external marks or burns. Such results have been noticed and recorded by a number of independent observers in this and other countries.

"There is much doubt whether a flash could have been seen by the witness, without leaving any burn. This could hardly occur unless the flash seen was at some other point in the circuit, such as at the insulator.

"Slight shocks to persons from wood poles are by no means uncommon, and severe shocks and death from contact with arc lamp chains have occurred. The slight current leak through a man or down a wood pole might very possibly occur through or across insulation at the lamp, because of some chance ground, and yet not appear on test the following night."

Serious Shocks Always Burn

"Several people who have had a large range of observation of electrical accidents state that electrical shocks of a serious nature always burn the injured. Although in some cases the wound may be small, it is, as far as can be learned, always large enough to show the electrical cause, and the wound is apparent for several days, at least, after injury. I have not been able to find a record of a post mortem examination when an electrical shock was the cause of death, as the wound itself has always been considered sufficient indication."

"In case of bad heart trouble it is said that coagulation of blood would not be centered in the heart, but a post mortem would show that there were clots of blood throughout the system and that a man suffering from heart trouble to this extent might easily be killed by a very slight shock. It does not seem possible that a man could be killed from electric shock from an arc lamp circuit of 2200 volts without showing some evidence of where the current entered or left his body."

Ontario Commission's 1915 Rates

The Hydro-electric Power Commission have announced a very general reduction of rates throughout the area served with Niagara power. This is the result of a total surplus for the past year somewhere in the neighborhood of $1,000,000 which, according to the policy of the Commission, is not used as a rest or reserve fund, but is immediately available for reducing the rates to the municipalities concerned.

The city of Toronto is the only municipality not included, these rates being still under consideration.

One of the most noticeable features in connection with the announcement is the change in the method of charging specially calculated to encourage the use of current-consuming devices. In this way it is now held that electric cooking will compete favorably, as to cost, with gas or coal in most of these municipalities.

In addition to a flat rate of 3 cents per 100 ft. of floor area the basis on which the monthly meter charges will be calculated is as follows:—For the first three kw.h. per 100 ft. of floor area consumed, plus an arbitrary constant of 10 kw.h., the consumer pays the regular rate given for that municipality. For all the consumption above this amount, the meter rate is one-half the regular rate. The floor charge mentioned above, which has been 4c per 100 sq. ft. in the majority of cases and in some cases 5c, is now standardized at 3c per 100 sq. ft. The minimum floor area for a city or town is 1,000 sq. ft., for a village 1,200 sq. ft. and, where a residence is more than usually isolated, 1,500 sq. ft. A maximum of 3,000 sq. ft. has been placed on all residences.

Or, putting it another way—the primary rate is charged on all consumption up to an amount equal to 4 kw.h. per 100 sq. ft. for the first 1,000 sq. ft., and the secondary rate (one-half the primary) on an amount equal to 3 kw.h. for each additional 100 sq. ft. floor area over 1,000; always remembering that the minimum floor area considered is 1,000 sq. ft. and the maximum, 3,000 sq. ft.

As an example of how these rates work out, let us consider a customer with a floor area of 1,800 sq. ft. in St. Thomas, where the meter rate is 2c and suppose his monthly consumption is 80 kw.h. His floor charge will be 18 x 3 equals 54c. His meter charge will be 18 x 3 plus 10, equals 64 kw.h. which at 2c equals $1.28. The balance of his meter charge is 80 minus 64, equals 16 kw.h. at 1c, equals 16c. The total bill then is 54c plus $1.28 plus 16c, equals $1.98, or an average rate per kw.h. of $1.98 divided by 80, equals 2.475c. From this is deducted a 10 per cent. discount, leaving the net charge per kw.h. 2.2275c, or approximately 2¼c. With a still greater consumption the rate would be less.

With this new rate everything will depend on the consumer using more current. It is probable that 80 or even 64 kw.h. is considerably in excess of what the average householder with a floor area of 1,800 sq. ft. will consume, unless he is using an electric range. It is doubtful if the little appliances such as toasters, electric irons, vacuum cleaners and so on will consume this amount. While at first sight, therefore, this new scheme looks to be a considerable reduction, it is plainly only going to benefit the housekeeper who either makes up her mind to do everything electrically, or to be very prodigal of her current consumption for illumination and general utensil requirements.

The new rates for both domestic and commercial lighting are given below; 10 per cent. discount for prompt payment in every case.

	Domestic Rates.		Commercial Rates.		
Municipality.	First 3 Kw.h. per 100 sq. ft. + 10 Kw.h. Minimum 10 Kw.h. Maximum 100 Kw.h.	All additional consumption.	First 30 hours per Kw. of installed capacity.	Next 70 hours.	All over 100 hours.
Acton	5	2½	10	5	1.0
Ancaster	5	2½	10	5	1.0
Baden	4	2	8	4	0.8
Barrie	4.5	2¼	9	4.5	0.9
Beachville	4.5	2¼	9	4.5	0.9
Beaverton	4	2	8	4	0.8
Berlin	2½	1¼	5	2½	0.5
Brampton	2½	1¼	5	2½	0.5
Brantford	3	1½	6	3	0.15
Caledonia	4	2	8	4	0.8
Cannington	4	2	8	4	0.8
Chesterville	5	2½	10	5	1.0
Clinton	5	2½	10	5	1.0
Coldwater	4	2	8	4	0.8
Collingwood	4	2	8	4	0.8
Creemore	7	3.5	14	7	1.4
Dundas	2½	1¼	5	2.5	0.15
Elmira	4½	2¼	9	4.5	0.9

Elmvale	4½	2¼	9	4.5	0.9
Elora	4½	2¼	9	4.5	0.9
Fergus	4½	2¼	9	4.5	0.9
Galt	2.5	1¼	5	2.5	0.5
Georgetown	4	2	8	4	0.8
Goderich	4.5	2¼	9	4.5	0.9
Guelph	2¼	1⅛	5	2¼	0.6
Hagersville	4.5	2¼	9	4.5	0.9
Hamilton	2¼	1⅛	5	2¼	0.2
Hespeler	4	2	8	4	0.8
Ingersoll	3½	1¾	7	3.5	0.7
London	2	1	5	2	0.5
Midland	2½	1¼	5	2½	0.5
Milton	3½	1¾	7	3½	0.7
Mimico	3½	1¾	7	3½	0.7
Mitchell	4	2	8	4	0.8
New Hamburg	3½	1¾	7	3½	0.7
New Toronto	4	2	8	4	0.8
Norwich	3½	1¾	7	3½	0.7
Ottawa	2	1	5	2	0.5
Paris	3.5	1¾	7	3½	0.7
Penetang	3	1½	6	3	0.6
Peterboro	2.5	1¼	5	2.5	0.5
Petersburg and St. Agatha	6	3	12	6	1.2
Port Arthur	2	1	5	2	0.5
Port Credit	3½	1¾	7	3½	0.7
Port Dalhousie	3	1½	6	3	0.6
Port Robinson	3	1½	6	3	0.6
Port Stanley	4.5	2¼	9	4½	0.9
Prescott	4	2	8	4	0.8
Preston	3	1½	6	3	0.6
Rockwood	4.5	2¼	9	4.5	0.9
Seaforth	4	2	8	4	0.8
Sebringville	5	2½	10	5	1.0
St. Catharines	2¼	1⅛	5	2¼	0.6
St. Marys	4½	2¼	9	4.5	0.9
St. Thomas	2	1	5	2	0.5
Stayner	4.5	2¼	9	4.5	0.9
Stratford	3	1½	6	3	0.6
Sunderland	6	3	12	6	1.2
Thamesford	5	2½	10	5	1.0
Thorndale	6	3	12	6	1.2
Tillsonburg	3½	1¾	7	3.5	0.7
Walkerville	4	2	8	4	0.8
Waterdown	4½	2¼	9	4.5	0.9
Waterloo	3	1½	6	3	0.6
Welland	2¼	1⅛	5	2¼	0.5
West Hamilton	4	2	8	4	0.8
Weston	3	1½	6	3	0.6
Windsor	4	2	8	4	0.8
Winchester	4	2	8	4	0.8
Woodbridge	4.5	2¼	9	4.5	0.9
Woodstock	2½	1¼	5	2.5	0.5
Woodville	6	3	12	6	1.2

The old saying, "It's an ill wind that blows nobody good," is applicable in a measure to motor trucking as regards the present United States interstate quarantine against foot-and-mouth disease. Strict quarantine in fifteen states is bringing horse transportation to a standstill at state lines But while interstate horse-haulage is thus checked to prevent spread of contagion, the immune motor truck passes through without suspended service or delay,—necessitating its adoption in place of disqualified horse teams, and pointing once more to the well-known fact that the motor truck is the eventual type.

The Robbins & Myers Company, Springfield, Ohio, have appointed Mr. C. R. Hunt and Mr. Guy H. Gibbs to take charge of their exhibits at San Francisco and Sandiego respectively.

Heated Entirely by Electricity

An electric installation presenting some unusual features was recently made in the Comparator Building of the Dominion Land Survey in Ottawa.

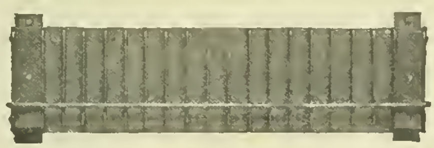
The building itself, which is 150 x 10 x 12 feet high inside, with a vestibule, etc., measuring about 10 x 15 is constructed of brick 22 in. thick, furred inside to allow a 1-in. air space and sheathed with matched lumber covered with tar paper. Next comes an 18-in. space filled with shavings, more sheathing, another 4 in. air space and finally the finished inside walls of double sheathing, making a total thickness of almost 4 feet.

The foundation goes to rock at a depth of about 6 feet, the space being filled in with cinders and 18 in. of shavings under the floor. Under the roof the insulation, also of shavings, is 4 feet thick.

The only openings are a double door, the inner one built like a refrigerator door; two small intakes, one at each end at the floor level; and a central vent in the roof.

A 24-in. motor-driven ventilating fan is suspended from the ceiling at each end, and by operating these fans, the air may be thoroughly agitated and a uniform temperature maintained throughout the room. To determine the temperature with great accuracy, while tests are being made, twelve delicate thermometers are placed round the walls, graduated in tenths of degrees, and may be estimated to hundredths.

Heat is furnished solely by 18 5-in. x 30-in. enamel type electric heaters mounted on the walls around the room and about 6 in. from the floor. They are thin ribbed castings



Heating unit for Comparator Building.

with the resistance enamelled to the back and with a low surface temperature and an exceedingly large radiating surface of approximately 2 watts per sq. inch. Two more heaters of slightly less radiating area are placed in each air intake, making a total of 22.

In planning the heating installation, owing to the construction of the building it was decided to assume radiation losses as 25 per cent. of the ordinary building, thus bringing electric heating into the range of financial possibility. The object being to maintain 60 degrees F. inside with 20 deg. F. outside, 5 kw. was decided on as the current required. To provide for extremes of temperature each heater was divided into two circuits, one of 167 watts and one of 333. A contract was made with the Ottawa Electric Company for a flat demand of 6 2/3 h.p., all excesses to be paid on a meter rate.

A special switchboard having a maximum capacity of 300 amperes at 110 volts was built. The board is somewhat similar to the ordinary distribution panel, but there are two distinct circuits. One of these is unmetered and divided into three branch circuits, one for the air intake heaters of 2,000 watts capacity, one for low heat circuit on the right side of the room and one for the low heat circuit on the left, each circuit being 1,500 watts capacity. On the metered side are the high heat circuits for the right and left sides of the building, totalling 2,100 watts each, and one switch for possible additions. Each branch switch has a capacity of 50 amperes which amply provides for future extensions; a light and a ground detector are also provided.

The rate given by the Ottawa Electric Company for the heating service was $27.00 per h.p. year, for the fixed load of 5 kw. or 6 2/3 h.p., or $180.00 per annum. For all current used over this minimum unmetered service a charge of 3 cents

per kw. hour is made, but this metered service is not required excepting with abnormally low temperatures, anything above 10 to 15 deg. F. being taken care of by the 5 kw. At the same time it was extremely necessary to provide the extra capacity for emergency use.

The building is excellently lighted and in addition to the permanent fixtures a small 110 volt toy transformer with variable secondary having a range from 2-26 volts was furnished and the circuit carried around the room with outlets at every instrument and microscope. Testers have small torches which they can plug in and use for making their readings.

To give some idea of the delicacy of the work carried on in this building and the absolute necessity of a uniform temperature the following brief description of the apparatus may be of interest. There are a series of concrete piers built up from solid rock and isolated from the floor, having fixed on them small plates bearing very fine graduations. The distance from pier to pier is determined by comparison with an invar bar, furnished by the Societe Genevoise, Geneva, Switzerland, and calibrated at the International Bureau of Weights and Measures, Paris. This bar, which has a coefficient of expansion slightly less than 1-10 that of steel, is supported on a carriage running along rails in front of the bench marks. Microscopes are used in making the comparison. The length from bench mark to bench mark is determined to within about .000005 of a foot. Having obtained this distance, the length of standard tapes may be determined to a very high degree of accuracy by comparison with the bench marks. It is here that the need of uniformity of temperature comes in, as an error of 1-5 deg. F. in the actual temperature of the tape would cause an error of .000124 feet in the length of a 100 foot tape when reduced to standard temperature. Other tapes are checked against these standards on a secondary apparatus 120 ft. in length, the tapes resting side by side on practically frictionless pulleys, in perfect alignment. This secondary apparatus was designed and constructed under the direction of the department. So Canada now has the honor of having constructed one of the most precise scientific instruments on the continent.

Electric heat for their buildings has frequently been used by companies or individuals having a surplus of power or as a convenience, where special conditions made a low cost possible, but to Mr. Deville, Surveyor General of the Dominion Land Survey belongs the credit of being the first to utilize power purchased at regular commercial rates from a regular lighting company, for the purpose. Mr. P. M. Grimes, of the Ottawa Electric Company, met the demand from the central station point of view in a most enterprising way and gave material assistance in determining the most advantageous rate and form of control. The heaters were designed and built by the Simplex Electric Heating Company, of Cambridge, Mass., and Belleville, Ont.

A notable electric heating installation in the Comparator Building of the Dominion Land Survey, Ottawa. Enlarged view of unit also shown herewith.

Good Annual Report

The Seventeenth Annual Report of the West Kootenay Power and Light Company for the year ending August 31st, 1914, showed gross receipts $424,262, and net, $304,544. Dividends on the preferred stock at the rate of 7 per cent. and on the common stock at the regular rate of 5 per cent have been paid during the year. This financial statement is more favorable than in the previous year. The report stated that an additional 8,000 h.p. unit was placed in operation about a month ago, the total cost of which was a little less than $120,000. This unit consists of an Allis-Chalmers turbine, Canadian General Electric generator and switchboard apparatus and Canadian Westinghouse transformer equipment. The president of the company is Mr. C. R. Hosmer; the vice-president and general manager, Mr. L. A. Campbell.

Standardizing Nomenclature

At a recent meeting of the Committee on Nomenclature and Standards of the Illuminating Engineering Society the following resolution was adopted:

Resolved, that it is the opinion of this Committee,

(a) That the output of all illuminants should be expressed in lumens;

(b) That illuminants should be rated upon a lumen basis instead of a candle-power basis;

(c) That the specific output of electric lamps should be stated in lumens per watt and the specific output of illuminants dependent upon combustion should be stated in lumens per British thermal unit per hour.

The resolution was approved by the Council of the Society December 10, 1914.

You can't stop the man who is in dead earnest.

Workmen's Compensation Legislation

James O. Carr in General Electric Review Outlines Conditions in Various States—Claim to have Evolved Workable Act in New York State — Ontario Act in Force Jan. 1.

One of the most remarkable reform movements in the industrial world of the United States in recent years is that which has had for its object the enactment of laws requiring the payment of compensation to workmen who are injured in the course of their employment. The theory upon which this movement has proceeded is that the workman should be compensated for disabilities resulting from industrial accidents regardless of the question of fault, and that the financial burdens of such accidents should be borne by the industry in general rather than by the workers alone.

While this principle has been in force in some of the European countries for many years yet it is only within the past five years that the matter has been taken up actively in the United States.

A law was enacted in the State of Massachusetts in 1907 permitting employer and employee to agree on a plan of compensation and the State of Montana passed a compensation act relating to the coal industry in 1909, yet neither seemed to accomplish the desired result and little or no progress was made thereunder. It really received its initial impetus in 1909 when a commission was appointed by the Legislature of the State of New York to investigate the whole subject.

During the year 1910, two compensation laws were passed in the State of New York, one elective and one compulsory, but early in the year 1911 the compulsory law was declared unconstitutional by the Court of Appeals of the State of New York, upon the ground that it took the property of employers without due process of law. During the year 1911, compensation laws were passed in the States of California, Illinois, Kansas, Massachusetts, Nevada, New Hampshire, New Jersey, Ohio, Washington and Wisconsin, some of which were compulsory and some elective.

Laws in Twenty-four States

Since that time, compensation laws have been passed by other states so that the principle is now in force or soon will be in twenty-four different states. One of the last states to enact a workmen's compensation law was the great State of New York, where the law was passed in the month of December, 1913. That law is in many respects the most liberal to the workman and the most burdensome to the employer of any compensation law passed by the various states. It was passed more or less hurriedly with the idea that the practice of compensating workmen for injuries sustained through industrial accidents should be commenced at once and that an actual trial of the law would show wherein it ought to be amended so as to improve it for the benefit of all concerned. It has been in actual operation since July 1, 1914, and it is already evident that many changes are necessary to make the law more workable.

Many of the most prominent labor leaders in the country have said that the present workmen's compensation law of the State of New York is the best compensation law ever passed in this country. That this is so from the standpoint of the workman is undoubtedly true. Many of the employers feel that the law ought to be less burdensome to them than it is. However, this will undoubtedly be worked out satisfactorily in time.

In most of the states the law is elective, that is, the employer and the employee may elect to accept the provisions of the law or not just as they choose. In the case of the employer who elects not to comply with the provisions of the law, however, all his defences are taken away in case the workman sues him for damages for personal injuries, so that the employer is almost compelled to accept the provisions of the law rather than to attempt to defend negligence actions and be subjected to the large verdicts which would certainly be rendered against him. If the employee elects not to accept the provisions of the law, he is relegated to the same rights which he had at the time the new law went into effect. In the opinion of many who are conversant with these compensation laws, the workman should only have the rights which existed at common law if he refuses to accept the provisions of the compensation law, the idea being to compel both parties to abide by the principle of compulsory compensation.

In some states the compensation law is compulsory, that is, both employer and employee must abide by the requirements of the law and the employer must pay the compensation therein provided.

Question of Constitutionality

The elective laws were passed by many of the states in order to avoid, if possible, any question as to the constitutionality of the law such as was raised at the time the first compulsory law was passed by the State of New York. The new law in many of the states provides that all workmen shall come under its provisions except farm and domestic labor. In other states, the laws are so framed as to cover only those workmen who are engaged in so-called hazardous employments. Where this has been done, however, some means have been found to include nearly all workmen. This very feature is one of the objections to the New York law because it is uncertain what workmen are covered by the law and what ones it does not cover. How much better it is for a workman to be under the protection of the compensation laws can readily be seen. As soon as he is injured, he is, in many of the states, entitled to medical attendance for a period of from two weeks to three months, at the expense of the employer. This also covers hospital treatment, medicine and other requisites. All of this is to be provided by the employer.

If the injury causes temporary disability of more than one week, in some states, and more than two weeks in others, which is called the waiting period, the workman is paid a certain percentage of his average weekly wages, ranging from 50 per cent. in some states to 66 2-3 per cent. in others, so long as the disability continues, subject to certain limitations as to length of disability and amount paid.

In some states in the event that an accident causes total permanent disability to the workman, he is paid the weekly percentage of his earnings for periods of time ranging from six years to the remainder of his natural life.

Difficult Complications

If the workman sustains a permanent partial disability, such as the loss of a finger, eye, hand, arm or foot, he is then paid a certain stipulated amount per week for a certain period to compensate him for the loss sustained. In some states he is also paid weekly compensation during the time of disability caused by the permanent injury; but the most satisfactory way seems to be to pay a certain fixed amount which is considered sufficient to compensate for the loss, and this is provided for in the laws of most of the states.

In some states, the workman is compensated for the loss

of earning power due to injury. This is likely to prove quite troublesome as time goes on and will lead to complications, as some of the Workmen's Compensation Commissions of the various states seem inclined to hold that if a workman goes back to work and takes a different job which pays less money than he earned at time of injury, he is therefore entitled to compensation for loss of earning power.

Method of Payment

If an injury proves fatal, then the widow, children or other dependents are paid a certain percentage of the weekly wages of the deceased workman. In some cases this compensation is paid for the life of the widow if she does not remarry, and in others, for a certain number of years and not to exceed a certain amount. The compensation to be paid to children usually ceases when they reach the age of eighteen. In addition, many of the states require the employer to pay a certain amount for funeral expenses.

The compensation is paid to the workman in various ways. In New York, for instance, the employer pays the money to the Workmen's Compensation Commission and it in turns pays the injured workman or his dependents. This plan is unwieldly and cumbersome and is not nearly as expeditious as the practice in many other states where the employer makes arrangements to pay the workman direct the amount provided by law pursuant to an agreement made between the parties which is subject to the approval of the Commission. In some states where the principle of state insurance has been put into effect, the compensation is paid direct to the workman from the premiums paid in by the employers. In some states, the compensation must be secured to the workman either through the medium of insurance in stock or mutual companies, through the medium of a state fund or, if the employer can give satisfactory proof of his financial ability to pay compensation to his employees, he may be permitted to carry his own insurance upon giving a satisfactory bond or depositing sufficient security to guarantee the payment of the compensation. Most employers carry insurance in either stock or mutual companies. Only the employers having a large number of employees can afford to carry their own insurance.

Various methods are adopted for handling disputes between the interested parties so that the workman may receive the compensation to which he is entitled as soon as possible after an accident.

As time goes on, many developments will take place in connection with the practical working out of these laws and we shall have a far better knowledge of them and their beneficial effects or otherwise five years hence.

That the general plan is sound and will work out to the interest of all concerned is probably conceded by all who have given the matter thoughtful consideration. The necessity for such legislation has been more or less forced upon us by the course of human events and by the many changes and developments in the method of carrying on modern industry.

The Burden on Society

Prior to 1880, the handling of business on a large scale and through the medium of great corporations was practically unknown, except perhaps with respect to railroads and the manufacturing interests in New England. Subsequent to that time, however, by reason of the great improvements in machinery, it became possible to have done by machinery the work which had formerly been done by the individual workman, and in many instances the workman was displaced by machinery. The result of this has been that in every industry the production has been marvelously increased and this feature has been largely instrumental in developing the great manufacturing industries in the United States. While enormous strides were being made in the manufacturing field, there was also a great increase in the number of industrial accidents due to the greater use of machinery and the hazard incident thereto. As a consequence, the burden on society was greatly increased because of the fact that the workman was seldom compensated for disabilities due to accidents occurring in the course of his employment.

In former years, when manufacturing was carried on in a small way by the individual employer, he usually knew most of his employees and took more or less of a personal interest in them and in their welfare. This resulted in a friendly feeling between the employer and the employee and there then existed a bond of human sympathy between them. It is also a fact that in those days the labor union was almost unknown and had little or no influence upon manufacturing operations.

With the development of the industry through the medium of machinery there came another development, that of the labor union, which to-day has almost a predominating influence in all parts of the country where large bodies of workmen are employed. With these developments and the creation and growth of the large corporations the human element was lost sight of in many ways. The workman was looked upon more and more as a machine rather than an individual. This, of course, was not true in every case, but it is true and must of necessity be so where thousands of workmen are employed in one industry since those in charge of the industry are absolutely unable to be in personal touch with all of the employees. This is also true where the labor unions predominate, because the members of the labor organizations seem to prefer to deal with their employers through the medium of their organizations and this has a tendency to eliminate the personal element.

In the days of small industries, when a workman was in trouble or was incapacitated through injury, he was, in many instances, looked after in some way by his employer who attempted to relieve him and his family from the loss which he was bound to sustain. It is not to be understood that this was so in every instance but it was in many cases. At the same time the employer who was engrossed in accumulating wealth undoubtedly very often overlooked the misfortune of his employee and was inclined to rely upon his legal rights in the event that any claim was made upon him for compensation.

Common Law Places Workmen at Disadvantage

The common law governing the relations of employers and employees in connection with injuries sustained during the course of employment was such that the employer was seldom legally responsible for injuries which happened to the workman in the day's work. The only way in which the workman could recover money damages from his employer was by proving that the employer was negligent and that he did not fulfil the duty which he owed the employee. It can well be realized how difficult it was for the employee to sustain this burden when he was obliged to prove that he himself was in no way negligent and that his actions did not contribute to the accident; that he did not understand the risk and did not assume it and that the accident was not due to negligence of some other employee engaged on the work. Prior to the enactment of the Employer's Liability Laws, in many states even the superintendent in charge of the work was held in many instances to be a co-employee, so that if for any reason the accident happened through his negligence the employee could not recover.

The law in these respects being so harsh upon the employee and the burden on society caused by industrial accidents having increased so rapidly, it became more and more apparent that there must be some enlargement made of the rights of the employee to recover for accidents sustained in the course of his employment. As a result many of the states have from time to time passed so-called employer's liability laws, placing a much greater burden upon the em-

ployer and relieving the employee in many ways. Up to the year 1912 these laws had become so drastic so far as the employer was concerned that it was more and more difficult for him to escape the payment of damages to injured workmen regardless of how the accident might have happened. This situation came about in many respects through the work of unscrupulous lawyers who became so skilled in negligence litigation that they could almost always find some means of making the case a question of fact which the Courts have held required the submission of the case to a jury. Within the past ten years the submission of such a case to a jury almost invariably resulted in a verdict for the plaintiff against the defendant. If the defendant was a corporation it was almost a foregone conclusion that the verdict would be a substantial one and that it would eventually be sustained by the Appellate Courts. Juries in the past five years have seemed to lose their reason and judgment when called upon to render verdicts in cases of this character. The amounts awarded by them have been astounding and unreasonable beyond any question. Passion and prejudice have undoubtedly prevailed in a great many cases of this character and have tended to influence the verdict. The defendant, however, has found it almost impossible to demonstrate that such was the case. The slogan has been: "The corporation is rich; it can stand it. Let's give the poor fellow a good substantial verdict."

Co-operation of Value to Both

By reason of this situation the employer who has been looking into the future has tried to establish for his own welfare as well as that of his employees, a system of compensation which would to some extent relieve the employees from the burden of industrial accident and that the employers have succeeded admirably in many cases is a well-known fact. That this should be done from a social standpoint need not be demonstrated. That it should be done from a business standpoint also requires no demonstration. The employee himself was made to realize that it was for his interest to co-operate with his employer along these lines when it became more and more apparent that the lawyers who handle negligence litigation were in almost every instance merely exploiting the injured workman for the purpose of getting the substantial fee which they would obtain in the event of the litigation being successful. The speculative feature of this class of litigation had a tendency to make the plaintiff as well as his lawyers disregard the truth in many instances, the sole object being to endeavor to obtain a verdict against the employer.

Many employers have for years been carrying on their own systems of compensation for injured and killed workmen and their dependents, and have been successful in their efforts in this direction and have succeeded in reducing the annoyance and expense incident to negligence litigation to a minimum and have thereby been able to increase the compensation and relief to the injured employee. Particularly is this true in respect to the employer who has handled his own insurance rather than by having insurance companies protect him through the medium of casualty insurance.

Workmen Needed Protection

Undoubtedly one of the greatest incentives to the enactment of workmen's compensation laws in the various states has been the methods adopted by casualty companies in conducting their business and in adjusting claims made by employees for injuries sustained by them. The attitude of the insurance companies until very recent years has been that they would not pay anything to the injured workman if it was possible to avoid it, preferring to rely upon their legal defences in case the workman saw fit to bring a suit. Whenever an accident happened the insurance company intervened between the employer and the employee and the employee was obliged to conduct his negotiations, if any, with the insurance company. Naturally the ordinary workman is not versed in matters of this character and he was at a tremendous disadvantage when attempting to do business with the representatives of the insurance companies. As a result he was imposed upon; he was unable to clearly understand his legal rights, and was made to understand that before he could hope to recover anything he would be obliged to go through a protracted litigation which might extend over a period of years and in the end it was possible and perhaps probable that he would be unsuccessful, in which event he would recover nothing. During all the time that this litigation might continue he would have the worry and annoyance of it and nothing to compensate him for his injury, which in many instances was serious; so that the insurance companies by use of such arguments were in most instances able to effect a settlement for a small amount and get the case disposed of. It is significant that the records show that prior to the time when compensation laws were first enacted in this country the amount disbursed by insurance companies in the way of payment of compensation to injured employees was about 30 per cent. of the total premiums, the balance being used by the insurance companies for the payment of their expenses and dividends to their stockholders. Of the 30 per cent. probably a large amount was paid over by employers to lawyers and others for assistance rendered by them. It can readily be seen that the real purpose for which insurance was taken out was not to insure the payment of compensation to the injured workmen when the accident was due to the fault of the employer, but rather to relieve the employer from making any payment whatsoever and as a result the workman received a small percentage of the amount to which he was really entitled and in addition considerable feeling was engendered between him and the employer. It was apparent to the manufacturers who were able to look ahead that this state of affairs coupled with the expense and annoyance incident to the harassing negligence litigation, could not continue much longer and that some remedy should be found which would make both of these things entirely unnecessary, and in addition enable both employer and his employee to work more in harmony with each other, and afford the man who was injured at his work a partial recompensation for the loss which he should sustain. The workmen were also beginning to think along the same lines.

Human Conservation

While the employers and employees may both claim the credit for workmen's compensation legislation, yet regardless of the question as to whom the credit belongs it may safely be said that it is one of the greatest steps in promoting social welfare that has occurred in modern times. It may well be termed: "The movement to conserve human life and health through the medium of legislative enactment." As time goes on both the employer and the employee will wonder why the great waste of human life and health which we have endured up to very recent years was permitted to go on unchecked when it was possible to remedy the difficulty so readily. It will also be found after these laws have been enforced for a short time that neither the employer nor the employee would be willing to go back to the old condition of things under any consideration. That it may be classed as paternal legislation is in one sense true, but on the other hand it is agreed that paternal legislation that brings desired results to all parties interested alike is the best kind of legislation that can be enacted. There can be no ground for arguing that such a law is unjust and inequitable, so far as the principle is concerned. In the years gone by the machine in the shop when out of order was shut down and promptly repaired so that it might be again put in use for the purpose for which it was designed and thereby enable the employer to make use of it in turning out his product. In

the same way the horse that was used for hauling the freight and other material around the plant when taken sick was promptly attended to by the veterinary. He was fed and cared for, and every effort made to put him in good condition so that he could again resume his work. To be sure no wages were paid to the horse but yet as compensation for the food and care which he received he performed a certain amount of work for the employer. That this condition of affairs should have been overlooked for so many years and these principles not applied to the human machine seems almost startling in the light of present-day developments. Why is it that the human machine did not receive equally as good care and treatment as the others? Was it because of selfishness or neglect or failure to consider the true merits of the situation? The answer undoubtedly is that when the human machine became out of order for any reason it could promptly be replaced by another without any trouble or apparent expense, and for that reason the man who was injured in employment was displaced, for the time being in any event, by another workman who was prepared to take up his work, and if the former employee had been so disabled as to be unable to resume his employment then the new one could remain on permanently. In the case of the horse it would cost a substantial sum of money to replace him even temporarily, whereas with the human being it cost nothing, so that the action taken may properly be said to have depended entirely upon the question of cost. Nowadays the employer is finding out that it is money well invested to keep the human machine in proper working order and condition. The benefits derived from his efforts in this direction are manifold. It is seen not only in the workman himself but the benefit redounds to his wife and children and to the public in general which is relieved from any apparent burden so far as he is concerned. If a man is in good physical condition he can naturally do more work and do it better than the man who is ailing and unfit for the employment in which he is engaged. The more and the better production the manufacturer is able to put out the more business he does, the larger his income, and presumably the greater his profits. The saving to the community in general, by reason of the enactment of laws regarding compensation of workmen who are injured in the course of their employment, will more than compensate for any additional expense to which the state may be put in administering such laws. Heretofore a large portion of the time of our courts has been devoted almost exclusively to the conduct of negligence litigation arising out of accidents to employees. In fact the calendars in some of the courts in the larger cities have been almost entirely filled with these negligence actions.

Will Reduce Litigation

Without question the work of the courts in such a state as New York will be so materially decreased by the disappearance of this class of litigation that many of the judges will have time on their hands and some of them could be dispensed with. When the enormous expense that is attendant upon the operation of the courts is realized it will be seen at a glance that a great saving is to be effected. In addition to that, the workman who is seriously injured is not going to be a burden upon himself and his family and upon society in general. He is not going to be made to feel that he is dependent on charity for his existence. He is still going to be able to hold his head up among other men, knowing that so long as he is deprived of his ability to work by reason of the injury sustained in the course of his employment he is going to receive compensation to assist him to a considerable extent in caring for his family during the time of his disability. This feeling of self-respect which the workman will have is in itself worth a good deal and will tend to make him in most instances a better citizen. The burden of compensating employees will be borne by the industry and when it is of sufficient amount to be at all appreciable it will be added to the cost of the production, and the consumer, which is the public, will pay for it. In this way society in general pays the expense as it really does in everything else ultimately. The workman who is compensated while injured will, by being able to receive enough to keep his family from want, also be able to keep his children in school and thereby confer an untold benefit upon them. They will not of necessity be obliged to start working when the wage earner of the family is disabled, whereas they might be obliged to do so much before the intended time if there were not other means of support.

Hard to Please Everybody

Of course it is impossible to have legislation of this character which is not without some drawbacks and subject to much criticism. In many of the states the claim is made that the compensation is too liberal and too far-reaching in that it will be an incentive where the compensation is too high for the injured workman to remain out of employment as long as he possibly can. Of course there may be something in this, particularly if the workman carries his own insurance either through insurance companies or some fraternal organization, for by taking such insurance benefits in conjunction with the compensation paid by the employer he may derive more than the sum which he would receive when working steadily. This, however, is a condition which must be met. In some states the list of dependents is carried to extremes, persons being entitled to compensation as far remote from the injured person as grandparents and grandchildren and nephews and nieces. It is undoubtedly true that the schedule of compensation for partial permanent disability seems in many instances high but time alone will tell how burdensome this may be in the states where such compensation seems to be unduly high. Fortunately this only pertains to a class of accidents which are fewest in number. That an untold amount of good is going to be accomplished by these laws must be admitted without controversy. It is going to have a tendency to cause employers to investigate more carefully their working conditions in order that they may ascertain wherein they may reduce the number of accidents in their factories. Every accident prevented means, theoretically, so many dollars earned, because by reducing the number of accidents the expense incidental thereto will be diminished. An employer will be warranted in expending money for the purpose of reducing the number of accidents because it will be found to be an excellent investment. The amount of stimulation that has occurred since the beginning of the agitation for workmen's compensation legislation is surprising. Many large manufacturers have been and now are spending thousands of dollars in safeguarding machinery and doing other things to decrease the hazard of the employment and make it safe for the life, limb and health of the employee.

Accidents Caused by Poor Lighting

Naturally these things have a tendency to improve the efficiency of the workman and his surroundings. One of the great elements which have been found to have a very important bearing upon industrial accidents is the question of lighting and it has been shown that many accidents which could well be prevented have been caused by failure to properly light the place where the employee was performing his work. It has been found a simple proposition in many ways to place these safeguards around the employee and thereby reduce the possibility of accidents and it is undoubtedly due to the fact that it has been so simple and easy to do these things that they have been left undone for so long a period of time. In another respect, outside of compensation for industrial accidents, the employee is bound to derive a substantial benefit. The bur-

(Concluded on p. 47)

Electric Railways

STOP — LOOK — LISTEN

A Brief Description of the "Safety First" Campaign Being Waged by Montreal Tramways Company

By Mr. A. Gaboury*

At the first suggestion of preparing a paper on "Safety First," I hesitated a little bit, feeling that, perhaps, "Safety First" was somewhat out of keeping with the war spirit of these present days; but on second thought, when we remember that we are all really fighting for our national existence, "Safety First" would seem to be very much in order.

The words "Safety First" have been given so much prominence during the past few years, that many are led to believe that this movement is something new, and many claims are made for the credit of originating it, but in my opinion these claims are made unwisely.

"Safety First" is not new, its origin is not of to-day or even of yesterday, but of long ago, in the dark ages when accidents happened by premeditated design and when claims were settled on the spot by right of might. In fact, as I understand it, we are indebted to this movement for our first record of transportation, as although the exact words "Safety First" were not stencilled on **Noah's Ark**, it was undoubtedly built as a means to that end.

"Safety First" appeals to one in two ways:—First: from the standpoint of humanity, and second: from the point of view of economy; and what better excuse can any campaign have than that it touches at the same time both our hearts and our pockets.

On the first point I don't think I need say very much; all are agreed on the good of any movement that will alleviate human pain or suffering or that will help in saving the lives of our fellow beings. On the second point I would submit that "Safety First" is but an old friend with a new name; in other words, it is **Efficiency** or the **Elimination of Waste**.

The tendency in these modern days is towards higher expenses, and every manufacturer, wholesaler, retailer and public service corporation feels the pinch of increased cost, of labor material and overhead charges; to offset this, increased efficiency and elimination of waste is necessary, and of all waste surely there is none more absolutely useless than **Accidents.**

Accidents are a costly, expensive, dangerous waste, whether a manufacturer, a public service corporation or a private individual is concerned; the damages, whoever may be at fault, are a pure loss, while money itself cannot repay the loss of life and limb.

Therefore, I think that from the economic standpoint, "Safety First" or the **Prevention of Accidents** or the **Elimination of Waste** should appeal to everyone, whatever his station in life.

From the viewpoint of a **Tramway Man** there are two parties to be considered in the "Safety First" campaign. On the one hand we have our own **Employees** and on the other hand, the **General Public**, and as the views of both are generally divergent, our aim must be to reconcile them and to get each one to **Stop, Look and Listen** for the other.

The company of which I have the honor to be superintendent has, during the past few years, devoted much time and money to the proper education of our men with a view to bringing the efficiency of everyone to as high a point as possible; in the first place, great care is taken in the selection of men; the physical standard is very high; the candidate must have some educational qualifications and must also show he is likely to be an apt pupil; when taken on as a student, he is educated with care and thoroughness and much attention is given to detail so that when he is finally passed as a full fledged employee he is as much as we can make him, a competent responsible man, able to take care of himself and to do his share in taking care of others.

It takes two to make a quarrel, and I might say **it takes two to make an accident,** and the deeper we have gone into this question of educating our own men, the more apparent it has become that the one party could not be considered without the other, that both must be treated as component parts of the whole, and that each must be taught to look at the question from the viewpoint of the other.

To this end, I had the pleasure of inaugurating a public campaign for "Safety First" early last spring, and the results so far have been astonishingly gratifying.

The congestion of vehicles on our principal streets had become such that accidents were daily becoming more numerous and some steps had to be taken towards the prevention of these accidents if we were to maintain the enviable position that our city has so far enjoyed.

Collisions between tramcars and vehicles are one of the most numerous types of accidents, and also the one that can be most easily avoided, if both parties are imbued with the spirit of **Give** and **Take** and each has due regard for the rights of the other.

Street cars must follow the tracks; they cannot turn out to avoid an accident; but a vehicle can, and if the motorman will give the driver sufficient time to turn off the track, and if the driver will take the chance to turn out, accidents of this type could be avoided easily.

Accidents of this kind naturally interest our company but it must be admitted by all that all owners of vehicles, whether rigs or automobiles, are equally interested, and in this spirit we appealed to all cartage and express companies, laundries, bakers, milkmen, departmental stores, etc., pointing out to them that their interests and ours were identical along these lines, and asking for their direct help in reducing the number of these accidents.

In the same spirit, we have sent out letters and literature to the home addresses of all drivers in the city, with the idea of impressing on them "**Mutual Help**" and "**Give and Take.**"

That these steps have been productive of results must be acknowledged by all, and I only mention them to show the spirit in which we have undertaken the movement.

In the hustle and bustle of these modern days, people are

*Superintendent Montreal Tramways Company.

apt to forget that conditions in the streets have changed rapidly in the last few years, and while, a few years ago, one might safely step off the sidewalk and cross the street at any point, it cannot be done now. The street can only safely be crossed at the regular street crossings and then, not before we remember to:

"STOP, LOOK AND LISTEN."

Most people are apt to dismiss the subject with the wave of the hand, **"Oh, I Can Look Out For Myself"** but it is just through this **"Care Free Feeling"** that accidents happen. All accidents are not the result of one's own carelessness but may be caused by the carelessness of another, consequently **no one is Free From Danger**; no one can say **"I Can Take Care of Myself"**; he may perhaps do that but he cannot take care of what the other man may do to him.

Take Care of Yourself, but Take Care of the Other Fellow Also.

All accidents can be traced directly or indirectly to negligence or carelessness on the part of some one, and our aim in this public **"Safety First" Campaign** is to eliminate, as far as possible, this negligence or carelessness, whether on the part of the tramway employees or the general public.

"Better Be Safe Than Sorry"

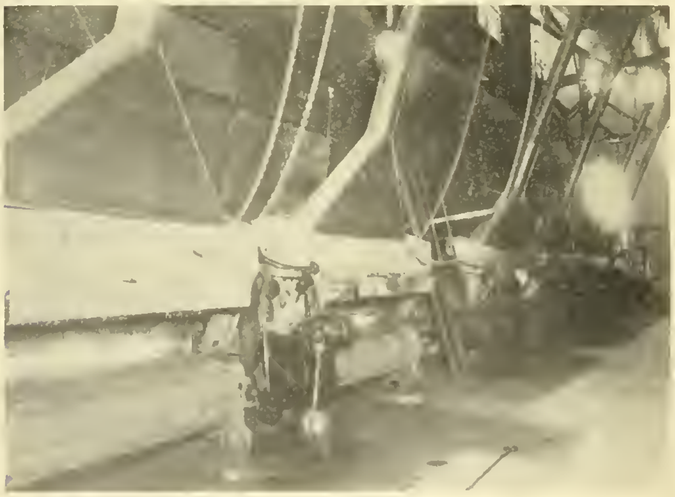
And if each one of us, whether tramway man, automobilist, driver or pedestrian, will only put his shoulder to the wheel and help, remembering that each is dependent on the other, it will not be long before the reputation for safe streets, and well regulated traffic will be enjoyed by every city and town in our fair Dominion.

NEW STEAM TURBINE UNIT FOR O.E.R.

An Addition of 4000 Kv.a. as Emergency Stand-by—Best Designed Equipment Throughout

A new steam power plant, built and equipped at a cost of $200,000, has just been put into operation by the Ottawa Electric Railway Company.

The power building is of brick on concrete foundation with concrete roof. The boiler room is 86½ by 40 feet and 48 feet high, equipped with three Babcock & Wilcox marine type water tube boilers, with integral superheaters, having a capacity of converting 90,000 lbs. of water per hour, with 200 lbs. steam pressure. Each boiler is fitted with a 5½ ft. smoke stack, 60 ft. high, with induced draught fan, driven by separate motor on each fan. The coal is kept in a concrete lined steel bunker of 300 tons capacity. This coal is crushed, elevated to the bunker and carried in spouts to the hoppers where it passes to Babcock & Wilcox chain grate motor-driven stokers. The ash is removed by spiral conveyors, elevated to a hopper, and delivered outside the building through a spout. Water is fed to the boilers by two Weir vertical pumps, each capable of supplying all the boilers. The coal crusher, elevator and conveyor, and the ash handling machinery are all motor driven.



Boiler room of O.E.R. Co.'s standby plant.

The engine room is 86½ by 25 ft. and 30 ft. high. It is equipped with one 4,000 kv.a., 2,400 volt turbo-generator, 3,600 r.p.m. The field is excited by a 60 kw., 125 volt, d.c. generator, direct connected to a 90 h.p., 440 volt, induction motor. The engine room also contains a 1,000 kw. motor-generator set.

Lately the Ottawa Electric Railway Company have been hard pressed to get sufficient power for their water plant, owing to the water in the Ottawa River being at a lower ebb at this time of the year than it has been at the same period in other years for generations. The new steam plant will thus serve as a timely auxiliary to the water power plant. Alternating current is transmitted from the new power house to the four sub-generator stations at different points on the O. E. R. system at a voltage of 2280 and there converted into direct current.

The new turbo-generator—4000 kv.a., 2400 volts.

This plant was built and equipped under the supervision of Mr. W. H. Baldwin, electrical superintendent for the O. E. R. Co. The electrical equipment was supplied by the Westinghouse Company.

New Ten-Inch Trolley Wheel

A new trolley wheel with some striking characteristics has just been placed on the market by the R. D. Nuttall Company, Pittsburgh, Pa. This wheel has a diameter of 10 inches, a size especially adapted for high speed service involving single car or train operation on 600-1200 volt, direct-current, or single-phase alternating-current roads. The wheel is said to be especially adapted for gathering heavy currents at high speed, and has an increased life of both the wheel and bushing over other types. The harps used with these wheels are light in weight and have contact washers which do not turn. The contact spring is riveted to the outside of the harp.

The councils of the municipalities of Rockwood and Stonewall celebrated the opening of electric car communication with Winnipeg recently, by a luncheon in the Stonewall Municipal Buildings.

The Dealer and Contractor

Electrical Contractors of Quality

The electrical contracting field seems to be more susceptible to the operation of "incompetents" than any other business on the face of the earth. There is no other known business where there are so many of the so-called "here to-day, gone to-morrow" kind in evidence. How can this be explained? Still more important—how is it going to be remedied?

Existing conditions, we believe, are as natural as they are undesirable. Electricity is in its infancy. Even where the expenditure of hundreds of thousands of dollars is involved in electrical equipments, many mistakes and omissions are yet being made. Is it anything more than natural then that where only a few dollars, often less than one hundred, are to be expended, the importance of the installation is underrated.

The fact is that the value and importance of the ordinary wiring and lighting job are out of all proportion to the expenditure involved. One per cent. or less of the total cost of a new building is often expended on electrical work. Yet the difference between safe and unsafe workmanship may be a disastrous fire, which destroys the building, or an accident which causes quite unnecessary suffering and delay; the difference between a skillful and unskillful lay-out means conveniences that save many hours of labor each day; the difference between good and bad lighting is the difference between efficiency and inefficiency, between good quality and bad quality—which again is the difference between profit and loss.

Of course the public cannot be expected to see this, but still worse, neither do a vast number of our "so-called" contractors. Either that, or they have no conscience. It is to eliminate this class in Ontario that the Hydro-electric Power Commission are preparing to recommend legislation requiring the licensing of all electrical contractors. As noted in our last issue, the Commission recently sent out a number of inquiries to the contracting trade to "feel out" the general opinion on this point. This precaution was really unnecessary as the replies were a foregone conclusion. We are advised by the Commission that, to date, of a very large percentage of replies received, no single suggestion unfavorable to their general scheme has been made. That is, no voice has, as yet, been raised in favor of incompetence. We trust the Commission will lose no time in putting the matter before the Ontario Government in its strongest light, and that a new start will be made towards establishing the electrical contracting business where it belongs—among the professions.

Doing it Electrically

The city of Calgary is wide-awake to the possible developments in the electrical business and the necessity of letting their customers know about it. One form of advertising adopted is shown in the accompanying illustrations for which, with a brief description of their advertising campaign, we are indebted to Mr. Robert MacKay, superintendent of electric light for the municipality of the city of Calgary.

Calgary's electric car at night—Results of co-operation.

Electric Car advertising Electric household devices—Calgary.

Mr. MacKay states that they made use of this electric truck to boost the electrical campaign in general, and particularly for the Christmas trade. The truck used is a five-ton electric, which is illuminated with an extra set of batteries. This truck is driven up and down the streets in the afternoon and evening, properly illuminated in the latter case, keeping to the central parts of the city on the principal streets. Much favorable comment was passed on the appearance of the truck and dealers in general reported that business, especially in heating appliances and lamps, was wonderfully boosted as a result.

To draw further attention to the idea of making this an electric Christmas, the Electrical Department of the city of Calgary pasted a small sticker, printed attractively in red

on a black background, to every letter and bill sent out by the department. This sticker is worded as follows:—

> **DO IT ELECTRICALLY**
>
> **GIVE ELECTRICAL APPLIANCES**
> **AS XMAS GIFTS**
> **AND SHOW YOUR GOOD JUDGMENT**
>
> **FOR SALE AT**
> **ALL ELECTRICAL SHOPS**

This campaign in Calgary is carried on by the concerted efforts of the contractors, the jobbers and the central station.

Fire in Edison Plant

A disastrous fire occurred at the plant of Thomas A. Edison at West Orange, N.J., on December 9th, resulting in an estimated loss in the neighborhood of $1,000,000. Out of 34 buildings composing the total organization three brick buildings were totally destroyed. It had been supposed that the new concrete buildings constructed of Edison cement were absolutely fireproof, but five or six of these were damaged by cracking and their contents rendered practically worthless. It appears that the concrete itself withstood the fire, however, and it is now claimed that if these buildings had been supported by metal frame-work and equipped with wire-glass windows, their contents would have been unharmed. The laboratory containing the office, library and experimenting rooms of Mr. Edison were not reached by the fire. As soon as it was seen that the fire was making dangerous headway, special efforts were directed towards the saving of these buildings, though the precaution was also taken to remove whatever records and books it was possible to carry out. It appears that the buildings destroyed were chiefly the phonograph works, and that, in addition to the private laboratory, the primary battery department was untouched.

The A. B. See Electric Elevator Company of Canada, Limited, are taking advantage of the dull days to completely equip a large elevator factory in the city of Montreal—where in future they will manufacture everything in connection with their elevators. This company will place large orders for machinery at an early date.

Just As Necessary as Life Insurance

An Open Letter to the Dealer, Contractor, and Central Station Owner. Only if the Cap Fits, Wear It

Dear Sir:—

What are you doing to acquaint the general public with the fact that electrical household appliances have now reached a state of high perfection—in fact, that they are as necessary as life insurance?

What trouble are you taking to display and demonstrate them?

What are you doing towards pushing the sale of electrical equipment?

If you are a central station man you know that every piece of new equipment installed means increased demand for electric current for all time. If you are a dealer or contractor, or both, you know that your business will prosper in proportion as you educate the public.

Isn't it plain that we are all working to the same end?

Isn't it plain, then, that we ought to work together? Are we working together? Are we even working individually as we should?

Sitting down and waiting for customers represents business methods as they were practised fifty years ago. But we have progressed since then. The public now look for different treatment—a little consideration, a little coaxing, a little convincing.

In the life insurance business a risk who walks into the office and asks for insurance is viewed with suspicion and word is passed along to the medical inspector to give him an extra searching examination. The tremendous development in life insurance business is due, quite as much to the aggressive solicitation methods used to develop this business as to the merits of life insurance itself. This is equally true in the electrical business which has quite as much merit as life insurance. However, the public have got along without it for a long time and unless you tell them with all the blandishments of the life insurance agent they will continue in the same old way.

What are you doing? Would you have been any good as a life insurance agent?

Now I am going to tell you what just one live dealer, successful in a big city, among keen competition, is doing.

1st. He has a simple, yet thorough, accounting system and he knows when he is making money—also when he is losing it; knows what he is spending on advertising; what kind of advertising brings the best results; how big his results are.

2nd. He has a fair display room but makes the most of it. He uses this room for displaying not for storing his equipment. Everything is neat, attractive, bright and clean—scrupulously dustless. Prices are attached in plain figures.

3rd. He believes in window displays—religiously. Why? He says it is because he has proven time and again that his gross sales are in direct proportion to the care and time he spends in dressing them. Dress them once a month, no result; twice a month, not much; every week, business looking up; three times a week, business brisk.

4th. He advertises in the daily papers—a little ad. every day. Not the same old thing people get sick of seeing, but a crisp, fresh message each morning—makes it co-operate with his window and store display.

Now I want to tell you—dealer, contractor, central station man,—that this fellow has the right idea. He is making money; getting himself known; boosting the electrical business, not only for himself, but for you and me (that means we are getting something for nothing, of which we ought to be ashamed unless we are doing our part) and if he is treating the public right (as I believe he is) this man will be a prince among electrical contractors one of these days.

What are you and I doing? Are we sitting tight or are we hustling for business?

Yours for "doing it electrically,"

U. Tensil.

Must Use Caution With Nitrogen Lamps

The more general use of nitrogen-filled lamps in stores, show windows and at other points where inflammable materials are within range, is causing some little apprehension on the part of the Fire Underwriters' Association, cases being already reported at points in the United States where threatened higher insurance rates have prevented the installation of these lamps altogether.

The high temperature produced by nitrogen lamps has been recognized, from the beginning, as an adverse factor, but so long as their use was confined to street and general factory illumination, with plenty of air space surrounding them, the danger element was negligible. With the encroachment of this lamp on the fields of residence and store lighting, however, where the areas are more confined and where the lamps are more liable to come in contact with fabrics of a combustible nature, the danger from fire has been increased and the question of their careful installation has assumed more important proportions.

It is only fair to the nitrogen lamp to point out that, as a store light, and especially for window show effects, there is apparently nothing now on the market to compete with it. This is not only on account of its high efficiency, but also because of the nearer approach to daylight and natural color effects which this lamp gives. This being the case, there should not be any doubt of the ultimate general use of nitrogen lamps for this purpose, but it has got to be recognized at the same time that their installation must be surrounded with a high factor of safety. That the danger is admitted and that precautionary methods are being taken, is evidenced at many points in Canada, where electrical inspectors, illuminating engineers and others interested, are already active gathering data and information which will enable them to take proper precautionary measures.

As an example of what is being done, we cite the case of the city of Winnipeg, where the city electrician, Mr. F. A. Cambridge, has already sent out letters to the electrical contractors of that city, calling attention to certain regulations which must be observed in the installation of nitrogen lamps. It may be added that we learn from the Hydro-electric Power Commission of Ontario, that they are also taking steps to deal with the situation in this province. Winnipeg requirements specify Mogul base, no composition in the sockets that will soften by heat, sockets and fixtures wired with asbestos covered wire, good ventilation, permit to install, and so on. These requirements are given in full in the letter which Mr. Cambridge has distributed, a copy of which we are able to reproduce. We also print the opinion of one of the leading oculists of the city of Winnipeg, pointing out the danger to the human eye of a too glaring light from the nitrogen-filled lamp, and emphasizing the importance of properly softening and directing such illumination. Mr. Cambridge writes as follows:—

Winnipeg, Man.,
December 16th, 1914.

Editor Electrical News:

Referring to our recent correspondence in reference to nitrogen-filled high efficiency lamps, I beg to enclose you copy of our latest bulletin in relation to the above, also copy of letter from one of our leading oculists Dr. S. W. Prowse in relation to this matter.

After fully considering the whole question we have been led to adopt the stand outlined in the Bulletin as we think the same is highly necessary from the fire standpoint alone. From tests we have made on a 250 watt lamp, we find the temperature of the glass just above the filament, when lamp is placed in a horizontal position and with a large green and white cone shade of glass attached to the socket, runs up as high as 428 deg. Fahr., and with no shade at all but with a thermometer placed in the same position, the temperature runs up to 341 deg. Fahr.

It is manifest from these readings that the indiscriminate use of these lamps would be attended with very great risk, particularly if used without any globes or shades in certain locations. I also find that hanging the above type of lamp from an ordinary Edison Key Socket, the composition handle of the socket becomes so soft as to lose its shape inside of thirty minutes. I also find that the outer shell of socket becomes so hot that it is impossible to handle same with the bare hands. The heat is further communicated to the rubber of the drop cord which would in time be rendered useless. In addition to these points, with the opinion of Dr. Prowse before us, we feel we are fully justified in calling for either the enclosing globe or the indirect style of lighting fixture, as we will certainly by taking such action not only reduce the fire hazard but also eliminate the injurious glare which would effect the eyesight if these lamps were used promiscuously.

Yours truly,
(Signed) F. A. Cambridge,
City Electrician

An Oculist's Opinion

Winnipeg, Man.,

F. A. Cambridge, Esq.,
City Electrician,
Winnipeg, Man.

Dear Sir:—

In accordance with your request, I write you my opinion of the effect of the light of the nitrogen-filled tungsten lamp on the eyesight of those exposed to it.

As a source of interior illumination this light is unquestionably too glaring, and for such purposes the lamp would require either to be enclosed in an opalescent globe or to be so situated that its rays do not reach the eye directly but only after reflection from the ceiling and upper portions of the walls of the room in which used—so-called indirect illumination.

I need not enter into the particular ill-effects of strong glaring light on the human eye, as these have long since been proven and are generally recognized, but I would consider that the lamp you demonstrated to me would, if used as demonstrated, be productive of those effects to an extent equalled by no other artificial illuminant I have seen except the naked electric arc light.

I am,
Yours truly,
(Signed) S. W. Prowse.

Bulletin to Contractors

To Electrical Contractors, Supply Dealers, etc.,

Your attention is drawn to the following:—

1. This department having investigated the new types of high efficiency—nitrogen-filled incandescent lamps, same being made up with ordinary Edison base, is fully convinced that their use is attended with considerable risk, unless properly regulated.

The department will therefore hereafter refuse to approve of the use of this type of lamp unless fitted with Mogul base irrespective of wattage. Dealers, supply houses or contractors upon making declaration as to the number of such lamps actually in Winnipeg stock, will be facilitated in dis-

posal of such stock, provided the lamps are installed in the manner following.

Lamps to be installed in suitable sockets having no material in their composition that will soften by heat.

Sockets or fixtures to be wired with asbestos covered or heater cord and to be ventilated.

Lamps to be enclosed in suitable diffusing globes or in indirect fixtures.

Ample ventilation to be furnished in globe and fixture to carry off heat.

Permit to install to be taken out in each case and work to conform to wiring rules.

2. The City proposes to endeavor to obtain power to enable it to regulate the sale of electrical appliances and to prohibit the sale of those deemed unsafe. You are therefore advised to refrain from purchasing appliances that are not on the "List of Approved Fittings," or that have not been passed upon by this department.

Yours truly,
(Signed) F. A. Cambridge,
City Electrician.

Winnipeg, Dec. 14, 1914.

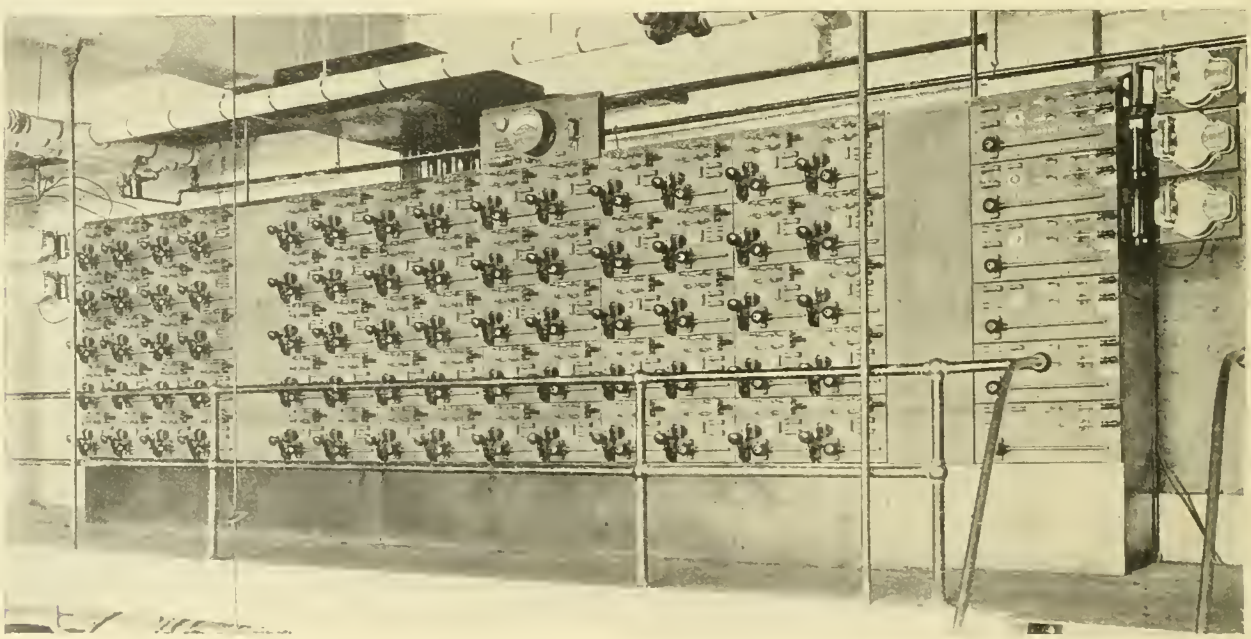
Charging Equipment for a Fleet of Electrics

A very complete electric vehicle charging outfit has just been installed by the Ward Bread Company of Boston. This company recently completed the building of their new Boston bakery, located in Cambridge. Electric delivery vehicles will be used as in New York and Brooklyn and the same make of battery charging equipment has been installed that has been in use in the above cities for several years. The charging equipment installation in the new plant shown in the accompanying illustration is located in a gallery in the engine room, adjacent to the garage proper. It consists of the unit section type rheostats built up into panels to meet the present requirement of charging 70 vehicles. Each unit takes care of two vehicles, there being seven panels of five each of these sections or a total of 35 duplex sections for charging 70 vehicles. At the extreme right are six special sections for charging, discharging and forming batteries.

Each of the sections of the charging equipment is a complete unit carrying cast grid resistance mounted directly on the back. The front carries a double-throw knife switch, a 15-step horizontal slider type rheostat; a reverse current circuit-breaker; enclosed fuses; and two 2-candle power indicating lamps, one for each of the two sets of batteries charged. Each unit carries two rheostats, each of which is designed for charging a 42 lead cell battery at 30 to 8 amperes. The double-throw knife switch mounted above each rheostat enables the operator to connect the batteries being charged to either side of the three-wire system, making it possible to keep a close balance on both sides. Special clips on these switches permit taking a reading of the charging current and voltage across the battery simultaneously and without interrupting the charging circuit.

In case the power is off or the current is reversed through the battery, the reverse current circuit breaker serves to disconnect each battery from the bus bars and is so interlocked with the rheostat slider that the attendant cannot begin to charge the battery without first placing all the resistance of the rheostat in series with the battery. Each charging outlet is protected by enclosed cartridge fuses.

Volt-ammeters are mounted on swinging brackets, the two at the left and the upper two at the right being used for taking readings of the charging circuits. These meters are connected in circuit only when taking a reading and this is done without opening the charging circuit. The third meter at the right is for the six-rheostat charging, discharging, and forming panel to which this meter is attached. Each of these units consists of a 30-step rheostat designed to charge the 42-cell batteries at 30 to 8 amperes and to discharge these batteries at 3 to 15 amperes.



Battery charging equipment made up of 35 Cutler-Hammer duplex unit type rheostats for charging 70 vehicles.

The small slate section mounted above panel No. 5 shown near the centre in the illustration carries a 300 ampere, zero centre reading ammeter and an overload relay, both of which are tapped into the neutral bus bar. If the current in the neutral rises above a predetermined value the relay causes an alarm bell to ring notifying the attendant of the out-of-balance condition. He can then divide the load by means of the double-throw switches on the charging units.

This charging equipment being made up in sections, permits of additions being installed very easily, as with a sectional bookcase. This is an important advantage since it has been practically decided that extensions will have to be made in a short time. The charging equipment described is the product of the Cutler-Hammer Manufacturing Company, of Milwaukee.

How the Worker's Eye Loses its Efficiency

Tests Covering a Wide Range of Time and Conditions Prove Value of Properly Distributed Light

A very complete scientific investigation of the effect on the eyes of various lighting systems, including daylight, has been carried out during the past three years by Dr. C. E. Ferree, and has just been presented at the Cleveland Convention of the Illuminating Engineering Society. While the scope of this work is quite comprehensive and we cannot report these tests fully herein, we give the essential results of this investigation which have to do particularly with the loss of efficiency of the eye, after a period of work under the various systems of illumination.

Loss of Efficiency of the Eye

Dr. Ferree in his investigation of the numerous aspects of lighting conditions, made a study of (1) the efficiency of the fresh eye and (2) the loss of efficiency as the result of a period of work. In beginning this series of tests to investigate the above, it was necessary to determine the important factors which tend to influence the efficiency of the eye. These, Dr. Ferree has singled out and classified as follows:

(1) Distribution Factors.
- (a) Evenness of illumination.
- (b) Diffuseness of illumination.
- (c) Angle at which light falls on the objects viewed.
- (d) Evenness of surface brightness in field of view.

(2) Intensity of illumination.

(3) Quality of illumination (Color).

Effect of Distribution Factors

In order to obtain results which would show the effect of variation of the distribution factors on the eye, factors (2) and (3) were kept as nearly constant as practicable and tests conducted under four types of lighting in common use, i.e., daylight, indirect lighting, semi-indirect lighting and direct lighting. Each of these systems of lighting gives different characteristic distribution factors. For instance, direct lighting is characterized by extremes of brightness differences and a high ratio of the brightness of objects in the field of view

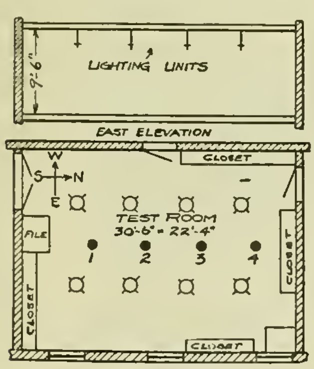


Fig. 1

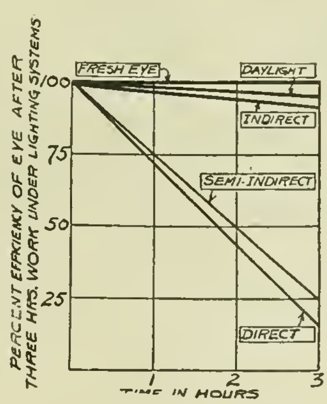


Fig. 2

to the brightness at the point of work. With semi-indirect lighting, this effect is much less marked and with indirect lighting and daylight, still less. Direct lighting has but a fair degree of diffuseness resulting in quite sharply defined shadows and the glare of specular reflection. Semi-indirect lighting has a somewhat higher degree of diffuseness and indirect lighting and daylight, still more diffuseness.

Fig. 1, shows the floor plan of the room in which these tests were made. The location of the outlets and test positions are indicated. The quality of light was made the same for the three systems by using clear bulb tungsten lamps with each. The intensity was made as nearly equal as possible at the point of test. In addition to this, a determination was made of the average illumination of the room under each of the three systems and the brightness of prominent objects. Photographs were taken of the room from three positions. In other words, a complete specifiation of the types of installation used and the illumination results produced are given in detail. They are quite typical of lighting conditions designated by the terms, direct, semi-indirect and indirect.

Without going into detail as to the method of test the procedure is briefly this: The fresh eye is tested under the

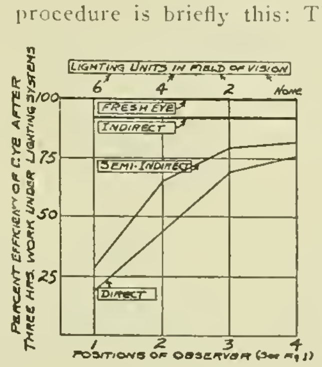


Fig. 3

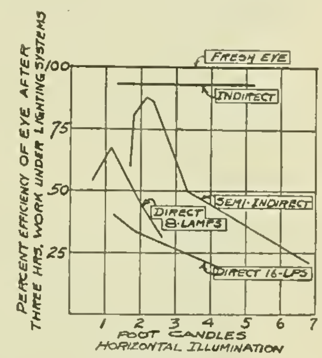


Fig. 4

lighting system; then the observer is required to read for three hours seated at the test position. After the three hours of reading, another test of the eye is made and the relative fatigue determined. This was repeated for each system of lighting.

Dr. Ferree devised a special test for the specific purpose of measuring the efficiency of the eye. It has proved very successful, and gives consistent results.

The results of these tests are shown graphically in Fig. 2. The abscissae represent hours of time and the ordinates, efficiency of the eye. In each case, the efficiency of the fresh eye is taken as one hundred per cent. for comparative purposes. It will be noted that with daylight and indirect lighting, the eye loses practically nothing in efficiency after three hours of work, whereas for direct and semi-indirect illumination the eye loses enormously in seeing efficiency. In other words, these latter systems cause rapid and heavy fatigue.

In order to determine the effect of relative distribution and number of bright surfaces (particularly lighting units) in the field of view, similar tests were run at different positions, 1, 2, 3 and 4, for the three artificial systems of lighting. The results of these tests are shown in Fig. 3. The abscissae represent test positions and the ordinates, efficiency of the eye.

For position 1, it will be noted that practically the same relative loss in efficiency exists for each system as shown in Fig. 2. However, as the number of bright surfaces (particularly lighting units) is diminished in progressing from positions 1 to 4, the relative fatigue or loss in efficiency of the eye for the semi-indirect and direct systems decreases, whereas for the indirect system, it remains practically constant. Even at position 4, the direct and semi-indirect systems show a much more marked loss of efficiency of the eye, than the indirect, although in this position the ratio of the brightest surfaces in the field of view to the brightness of the test card is not markedly different for all three systems. This indicates

that the other causes enumerated under distribution factors are contributing to this deficiency of direct and semi-indirect systems.

Effect of Intensity

In order to find the effect of the intensity of illumination on the eye and the most favorable intensities for least loss of efficiency, the factors 1 and 3 (distribution and quality) were kept as nearly constant as practicable, and tests made with various intensities of illumination for each of the three systems of lighting. The tests were made in the same room, Fig. 1, with the same fixtures and under identical conditions. To secure the various degrees of intensity required, lamps of different wattages, were used and in this manner the quality of light kept the same. In order to keep the distribution of illumination and brightness of surrounding surfaces as nearly constant as possible, the lamps used for any particular system were all of the same size, i.e., all 15-w., 25-w., 40-w., etc. In order to secure relatively the same distribution of light from the smaller lamps, socket extenders were used in order to bring the lamps in their proper relation to the reflectors. Tests were made only at position 1, in which position six lighting units were in the field of view.

These results are given in Fig. 4. They show that for indirect lighting, the loss of efficiency is very low and that it is practically constant for all intensities ordinarily encountered in practice; that with the direct and semi-indirect lighting system, the loss in efficiency is very great, except for a very limited range of intensities (1.75 to 2.5 for the semi-indirect and 1.0 to 1.5 for the direct) and that the intensities between these limits are too low for most purposes of work.

Does This Look Like *Your* Show-room?

One of the most attractive electric store interiors we have seen is that illustrated in the accompanying photograph. This is the store of Mr. Geo. J. Beattie, 72 Victoria Street, Toronto. No pains have been spared in making this as alluring as possible, and yet there is nothing in the scheme that might not be carried out by any electrical contractor with an average amount of stock-in-trade. An especially noticeable feature of this display is the scheme for suspending the lamp units from the ceiling. In this case Mr. Beattie has worked out a simple little idea of his own, by means of which units may be moved from place to place or replaced entirely by others with a minimum expenditure of time and without leaving traces of destruction on the ceiling.

Interior view of "The Electric Shop"—Everything shown, but no crowding.

Mr. Beattie finds that a store maintained in this way is a paying proposition, not only at Christmas time, but throughout the year. We trust that our readers will find some suggestions in this photograph that can be worked out to advantage in their own display rooms.

Manufacturer Makes Special Display

Taking advantage of the Made in Canada campaign, the Renfrew Electric Manufacturing Company, Limited, Renfrew, Ont., arranged for the special display of their goods in several stores, two of which we illustrate. One was the store of the Corporation of Westmount Light and Power Department, 4188 St. Catherine Street West, Westmount, and the other the store of the Electrical Equipment Company, Limited, 410 St. James Street, Montreal. As will be seen from our cuts, both windows were well arranged, and could not fail to attract the attention of passersby. In the Westmount store the keynote was the Made in Canada idea, emphasis also being laid, by means of showcards, on the economies which result from the use of electrical domestic articles. A seasonable touch characterised the display of the Electrical Equipment Company, bringing home to possible purchasers the desirability of buying for Xmas and New Year presents

This window emphasizes the "Made in Canada" idea, at the same time drawing attention, by the show cards, to the economies which may be affected by the use of electric domestic appliances.

One of a number of the simultaneous displays recently arranged by the Renfrew Electric Co. This window was specially calculated to tell the public about the utility of electrical appliances.

articles which are of value from the utility point of view.

The goods displayed include portable air warmer, finished in polished nickel and with perforated covering of burnished copper; electric iron, furnished with separate stand or detachable combination back stand; "Canadian Beauty" toaster stove, which toasts, boils, fries, or broils; electric toaster made in polished nickel; electric coffee percolator; electric disk stove, designed for use with coffee percolator, tea samovar, small kettle, frying pan, etc., electric luminous radiator and foot warmer, finished in either brushed brass or oxidised copper; and electric tailor's iron, which will stand continuous heat.

Such displays are evidence that the Canadian manufacturer of electrical specialties is alive to the opportunities in his particular field. There is no reason why Canada cannot produce goods of at least equal merit to the imported articles, and it is satisfactory to note that in this department we are supplying demands which not very long ago were almost entirely met by goods made outside the Dominion.

Mr. Irving Smith, Unity Building, is the Montreal representative of the Renfrew Electric Manufacturing Company.

No Delay Through Fire

The recent fire in the factory of the Robbins & Myers Company, Springfield, it is announced, did not injure their electric plant in any way. The only damage was in two of the buildings in the foundry plant, and arrangements were made with nearby manufacturers, within a few hours after the fire occurred, whereby foundry facilities will be furnished the workmen of the Robbins & Myers Company, until their own building can be replaced. The company announce that they will experience but little inconvenience and that the only delay in their production will be the few hours it has taken to transfer their patterns to the adjoining foundries. They have a large stock of castings on hand, and can make delivery as usual

A "Made in Britain" Exhibit

The Canadian British Engineering Company, Limited, recently held an exhibition of British-made machinery in motion at their showrooms, 85 Lombard Street, Winnipeg. The demonstrations were held daily at 11 a.m. and 3 p.m., from December 7th to the 12th. A large number of invitations were distributed, not only to city customers, but to interested friends at many other points in Canada, the invitation being extended to these latter to visit the showrooms when they paid their next visit to the city of Winnipeg. The exhibits included the following:—electric lighting plants; electric motors; air compressors; water lifting appliances; switch gear; electric instruments; telephones; belting; steam traps; electrical supplies; agricultural machinery, etc. The idea is a most excellent one, and well calculated to demonstrate to the Canadian citizen that all his machinery requirements can be supplied without going outside the British Empire.

Una-Flow Engines

The Mesta Machine Company of Pittsburgh, Pa., have recently acquired the rights from the Stumpf Una-Flow Engine Company of Syracuse, N.Y., to build the Stumpf Una-Flow type of engine in the United States. The agreement not only gives the Mesta Machine Company the patent rights of Prof. Stumpf, but includes the use of the knowledge gained by the practical experience, during the past five or six years, of European builders of Stumpf engines. The large number of engines of this type in operation in Europe is proof of its simplicity and economy. The Mesta Machine Company is, at present, making detailed shop drawings of various sizes of engines for rolling mill purposes. In addition to rolling mill engines, large units for driving electric generators, air compressors, hoisting engines, etc., will be built. In European mills, many existing engines having the ordinary type of cylinder have been equipped with Una-Flow cylinders and have thereby been made simpler and more economical. It is expected by this company that similar changes will be made in this country.

Further Eureka Improvements

The Onward Manufacturing Company, Berlin, Ont., announce that they have recently added a further improvement to their Eureka cleaner in the form of an enlarged armature commutator. In addition to this the carbon brushes are now twice the former size. It is claimed that these improvements will give the machine still more power and better wearing qualities. The company also state that they have just received a supply of a life-size cut-out of a girl operating the Eureka machine, similar to their well-known cut. These are furnished Eureka dealers on request.

Reco Color Hoods

The Reynolds Electric Company, Chicago, advise us of a second important decision relating to Reco color hoods as follows,—

"The Court of Appeals affirms the Lower Court in a decision handed down on December 6th, 1914, sustaining all of the legal rights relating to Reco color hoods.

The Reco patent is valid and meritorious and will be vigorously protected against any infringers.

The superiority of Reco color hoods over every similar device was clearly shown from the standpoint of design, utility, quality and practicability, as evidenced by two affirmative decisions by the United States District Court, as well as the Circuit Court of Appeals."

Trade Publications

Magnetic Switches—Booklet issued by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., describing and illustrating minutely their new line of magnetic switches.

Single-phase Motors—Bulletin 106, distributed by the Wagner Electric Manufacturing Company, St. Louis, describing, with illustrations, Wagner single-phase motors.

Motor Starters—Booklet issued by the Cutler-Hammer Manufacturing Company, Milwaukee, describing and illustrating in detail this company's automatic motor starter.

Lighting Connections—Vest pocket size booklet issued by A. P. Lundberg & Sons, electrical engineers, London, England, dealing exclusively and exhaustively with the provision of convenient switch control as regards illumination. This booklet contains a fund of information, exceedingly valuable to the electrical contractor.

Electric Specialties—1915 catalogue of the Chelten Electric Company, Philadelphia, Pa., describing the electric specialties manufactured by this company. The catalogue treats such subjects as switches, plates, receptacles, plugs, switch boxes, ground clamps, etc. Well illustrated.

The Compensarc—Booklet issued by the Canadian General Electric Company, describing the compensarc and other electric current savers for moving picture theatres. The compensarc is claimed to be the only device which will adjust the current in the arc without breaking the circuit, a feature which will be appreciated by every moving picture operator.

Westinghouse Publications—Folder 4287, describing the use of electric power in flour mills. Folder 4152, illustrating and describing the Westinghouse sewing machine motor, its application and operation; folder 4286 describing Westinghouse insulating tapes; Light and Your Eyes, a little treatise on the subject of the effect of illumination on the eye; and What the Users of Cooper-Hewitt Light Say About It, some interesting experiences, illustrating the preference of workmen for this form of illumination.

What is New in Electrical Equipment

Probably no new small development in the way of adding to the usefulness of electrical devices has taken quite such a hold of the public, as the use of the standard dry-cell for flash light purposes. As may have been expected, the popularity of this idea has resulted in a number of very ingenious methods of utilizing these cells.

The scheme is so simple and yet so satisfactory, that we cannot all help wondering why we did not think of it before. In some of the latest types, which are designed with the further idea of cutting the cost of the outfit, the lamp equipment is reduced to a minimum, as may be seen from the accompanying illustrations.

Fig. 1 is a type manufactured by the Manhattan Electric Company, New York City. This lamp combines simplicity and durability. As may be seen, it is a matter of only a few seconds to remove the lamp part from a cell, which may be worn out, and attach it to a new cell. With ordinary use, that is, used as a flash and not as a steady light, these units

Fig. 1—Manhattan Elec. Co.'s flash light.

Fig. 2—Metal specialties —note tilting feature.

will last a very long time. It is even claimed that they will give twenty-five hours, and in some cases more, of continuous service. As the cost of a new cell is only about twenty-five cents, this means a continuous emergency service, anywhere, without notice, at one cent per hour. Even at that the low cost is probably less important than the long life of the outfit.

Fig. 2 shows another lamp, embodying the same idea. This is manufactured by the Metal Specialties Manufacturing Company, of Chicago. As pointed out in their descriptive circular, a lamp of this type has a daily use by the farmer, plumber, autoist, inspector, housewife, physician; in store or factory, barn or garage, cellar or attic. It is absolutely safe around gas, gasoline, oil or hay, for it cannot ignite anything, however inflammable. It is clean and has neither smell, heat nor smoke.

Note that this lamp can be tilted at any angle, a feature not contained in other types. This adds to the usefulness of this type, as it may be used for emergency reading, writing and like purposes to better advantage.

Fig. 3, another lamp of the same type, has been nicknamed the "Bright Eye." This is manufactured by the Burchwell Manufacturing Company, St. Louis, Mo., and is possibly a little more ornate in appearance. It is claimed that a No. 6 dry-cell will last for 100 hours of ordinary lantern usage. It is further claimed for this unit, that, being made of hardened

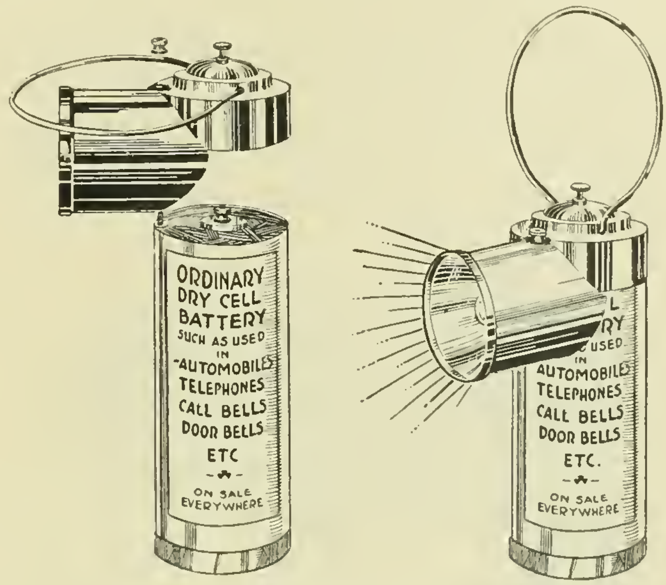


Fig. 3—The Burchwell "Bright Eye."

brass, it is practically indestructible, and also that the reflector has such a high degree of efficiency that a light is cast for 300 ft. This lamp is finished in brushed brass.

Frederick Rall, 19 Park Place, New York City, is offering the trade another type of portable flash light as shown in Fig. 4. This lamp has been given the name "Wonderlite." The switching and lighting part of the lantern can be readily attached to or detached from any standard dry battery, the manufacturers claiming that it will give from 40 to 50 hours of the sort of service demanded from this kind

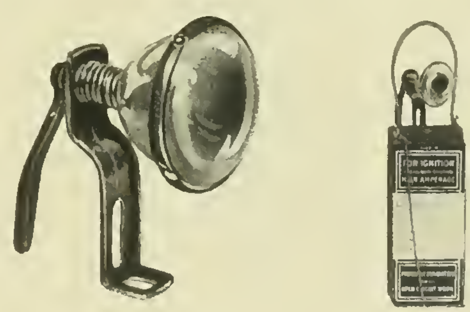


Fig. 4—Frederick Rall's "Wonderlite."

of lighting device. The value of this kind of lamp is greatly enhanced by the fact that the battery can be replenished at any supply or country store. A lamp of this sort is also very valuable for travellers who can make use of it in a hundred different ways.

Mr. Fred. M. Hoadley, consulting engineer, 802 New Birks Building, Montreal, has been commissioned by the Bishop of the Monastery at Oka, Que., to make a complete investigation into the possibilities of developing a hydro-electric power on the river running through the property adjacent to the Monastery, power to be used for different purposes on the property, including light. Mr. Hoadley has also been entrusted with the matter of installing an up-to-date fire protection system.

Circulation Water Heaters

With the electric range supplanting the use of the gas range for cooking purposes in a great many homes at the present time, there is a large field for the electric circulation type water heater as a means of heating water for household purposes. A number of the central stations are taking up the sale of this device actively and it has proven to be very much of a success.

The circulation water heaters meet all ordinary requirements and can be readily connected up to the kitchen hot water tank by a local plumber. There are two different types of these heaters, that is, the low capacity heater, primarily intended for continuous service, and the high capacity heaters, more especially designed for intermittent service. The heater recommended for continuous service with tanks not exceeding 40 gal. capacity consumes approximately 600 watts

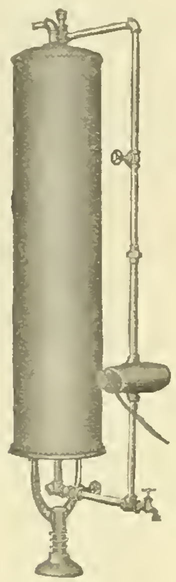


Fig. 1

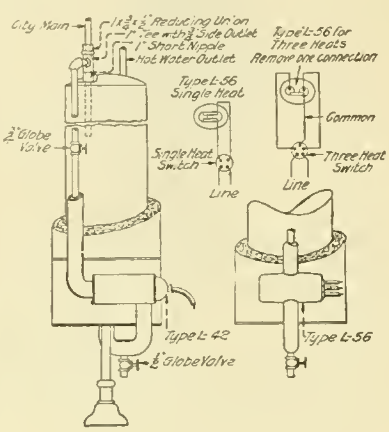


Fig. 2

and consists of a hollow, cylindrical cast iron core about 13 inches in length surrounded by a jacket of bent insulating material, making the outside diameter 4¾ inches. A cartridge heating unit is inserted in the cast iron lug which projects inward into the hollow casting and thus the space between the lug and the wall of the casting forms the water chamber of the heater. The heating unit terminals are covered and enclosed by a rounded shield of sheet steel which is secured to the lower end of the core, this shield having a bushed opening for the service leads.

The heater designed specially for intermittent service is similar in construction and is made in capacities of 1,000, 2,000 and 3,000 watts, with diameter at the centre slightly larger than at the ends. Cartridge heating units are inserted in two cylindrical lugs of cast iron which extend along the inside of the heater casting. These lugs are surrounded by water on all sides. The water inlet is located in the centre of the heater bottom and the outlet is at the top. The unit leads are connected to suitable terminals in a porcelain block at one end. These parts are enclosed by an end casting through which the heater cable projects. The overall dimensions of this heater are approximately 11 in. long with a diameter of 6 in. at the centre and 5½ in. at the end.

Installation

With the circulation water heater used in conjunction with the ordinary hot water tank, considerable care should be exercised as regards the installation, with a view of obtaining the highest efficiency. Fig. 2 shows the heater as it should be installed in a horizontal position. The intermittent type heaters are connected for single heat but may be readily changed to three heats as indicated. The piping shown in Fig. 2 is, of course, arbitrary, and may be changed to meet conditions or requirements of present installations. To obtain the best results, it is desirable to cover the hot water tank with 2 inches of magnesia asbestos slabs over which a thin layer of magnesia cement should be spread to fill in the cracks between the slabs. In place of this magnesia, 2 inches of hair felt may be used over which a canvas covering should be placed which may either be sewed or glued in place. It is also desirable that the pipes be covered with 1 inch magnesia pipe covering.

Operation

When these heaters are connected for three heats, the high heat, of course, is used for initial heating and the low heat for maintaining. The cold water entering at the bottom of the heater becomes heated and rises to the top of the tank. This circulating action continues until the entire contents of the tank become hot. As already stated, the method of installation is very important, also the kind and manner of lagging, the temperature of the incoming water and surrounding air, the manner in which the circuit is manipulated, that is, whether it is left on just long enough or too long, all enter in to make it practically impossible to tell just what can be expected from one of these heaters.

The accompanying curves, Figs. 3, 4, 5, 6, are taken from tests made of heaters of different capacities operating in connection with 40 gal. tanks. These curves show the temperature of each succeeding gallon of water drawn off after the heaters have been in operation for various periods of time and are based on the assumption that the water enters the tank at 55 deg. F. The minimum temperature shown is that generally considered the proper temperature for a hot bath. Should the water be drawn from the tank until the temperature falls to this point, the temperature of the total amount of water drawn off will be approximately the average of the initial and final temperature.

Cleaning

It has been found, as is more or less natural, that there will be, at times, a certain accumulation of scale and sediment which may be readily removed by filling the heater

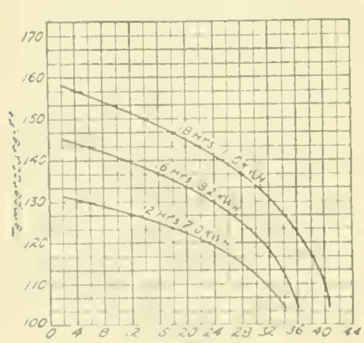


Fig. 3

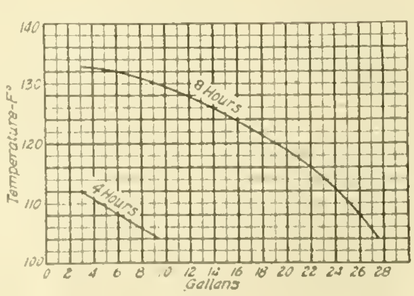


Fig. 4

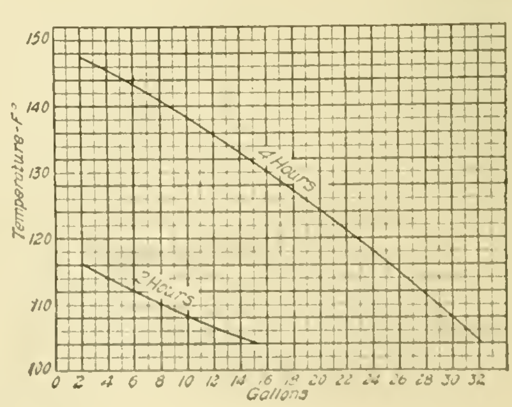


Fig. 5

with a solution of hydrochloric acid of 1.10 specific gravity. While the circulation type water heater was primarily designed and intended for intermittent use, the low wattage heater for continuous service is becoming very popular in

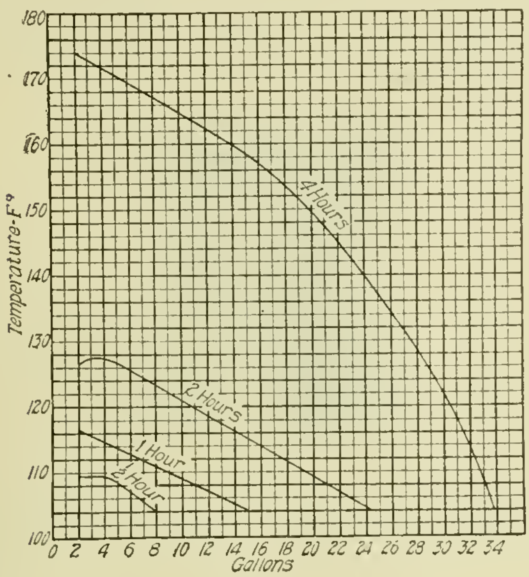
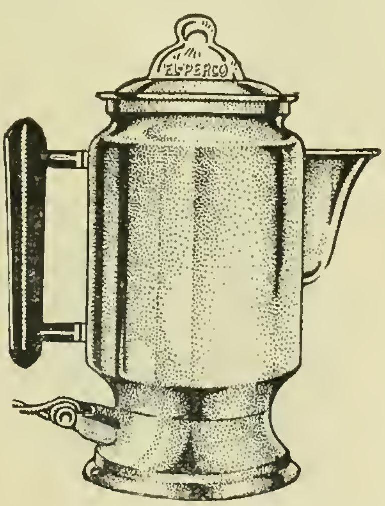


Fig. 6

the advent of cheap current and thereby providing 100 per cent. load factor on the central station. The equipment described in this article is being placed on the market by the Canadian General Electric Company.

Light-Weight Coffee Percolator

A light-weight coffee percolator, made in aluminium and German silver which cannot impart a metallic taste to the coffee has just been brought out by the Canadian Hotpoint Electric Heating Company, Toronto. It is provided with a lip-spout similar to that usually associated in the public mind with coffee pots. The heating unit, which is the same type as used in the flatirons made by this company, is guaranteed

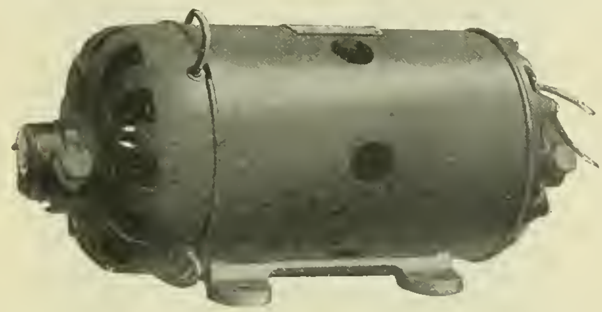


Percolator weighs 24 ounces.

for five years. It is clamped between a shoulder inside the pot and a nut in the base so that it can be replaced easily. Percolation starts thirty seconds after pouring cold water into the receptacle and turning on the energy. The device weighs only 24 ozs. The new percolator is illustrated herewith. The consumption is 4.1 amperes. We understand that 20,000 of these percolators are under order and that in consequence the price has been considerably reduced.

Small Motor-Generator Set

The small motor-generator set illustrated forms a convenient, economical and reliable means for charging automobile starting, lighting and ignition storage batteries. It consists of an alternating-current motor and a direct-current generator compactly mounted in the same frame. The motor operates from the 60 cycle, 110 volt alternating current lighting circuit and drives the generator which furnishes the current for battery charging. The generator is rated at 10 amperes and it can charge one or two 6-volt batteries or one 12-volt battery. Its voltage can be regulated from 6.3 volts to 12.6 volts by means of a field rheostat. The operation is very simple; merely connect the motor load to the electric light socket and turn the snap switch. Adjust the generator to the desired voltage and connect with the battery. No attention or voltage regulation is required during charging. The generator is so wound that its voltage rises automatically

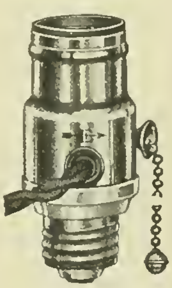


Set for charging storage batteries.

at the end of the charge so that each cell receives 2½ volts. The length is 19 inches, width 7¾ inches, height 3⅜ inches, shipping weight 140 lbs. The set is manufactured by the Westinghouse Electric Manufacturing Company, East Pittsburgh, Pa.

Arrow Electric Puts Out New Device

A new idea for a current tap has been originated by the Arrow Electric Company, Hartford, Conn. It consists of a pull socket with lamp base attachment and an outlet for



Arrow E

an extension, the latter being controlled independently of the lamp in the pull socket. The device is shown in the accompanying illustration.

The Robbins & Myers Company, Springfield, Ohio, announce the removal of their New York Office from 145 Chambers Street to 30 Church Street, Room 400E. The stocks of fans and motors will be handled at their warehouse, 155 Hudson Street.

At a recent meeting of the Hydro-electric Union of the Niagara district, it was decided to ask the Hydro-electric Power Commission of Ontario to make additional surveys for hydro radial lines from St. Catharines by way of Power Glen and Smithville to Hamilton; also from Niagara Falls to St. Catharines; also for a line connecting St. Catharines with Port Colborne.

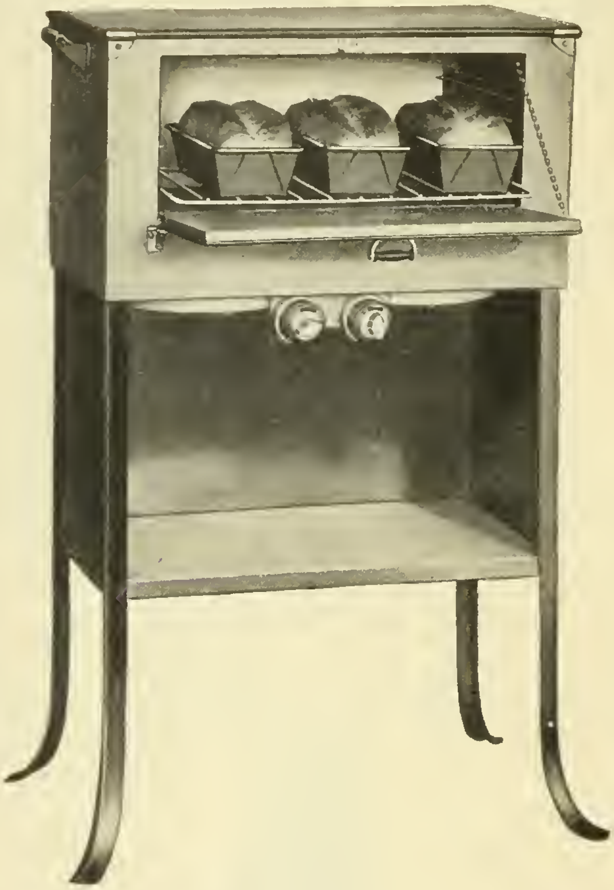
New Small Electric Range

To meet the demand for a low priced electric stove The Hughes Electric Heating Company, Chicago and Winnipeg, have put on the market the new "two burner" electric range shown in the accompanying cut.

The top is made of steel and is finished in black enamel. The shelf and metal frame underneath the top of the stove are of blue polished steel and the legs of malleable iron.

The heating elements consist of two standard units, each having a current consumption of 1,000 watts on the high heat, 500 on the medium, and 250 on the low.

The oven is heavily insulated. It is placed on top of the stove and can be set aside when not in use. As the weight of the oven is only 28 lbs. this is an easy matter. The inside is finished with special aluminium rust-proof preparation.



New Two-burner Range.

The low maximum demand of the stove makes it an especially attractive proposition from the central station standpoint. The dimensions are: height from floor to top of oven, 41 inches; cooking surface, 23 x 12⅝ inches; floor space, 28½ x 17½ inches; size of oven, 18 x 11 x 8 inches inside; net weight, complete, 60 lbs. The oven has a capacity of 3 loaves of bread, 2 pies, a 10-lb. roast, or 2 layer cakes. With the oven removed, the two open range burners make possible frying, stewing, and coffee making.

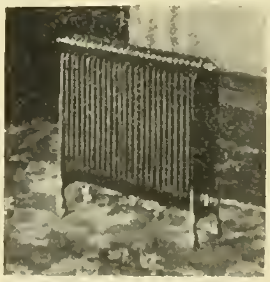
A Motor Driven Dishwasher

It is inevitable that the motor-driven dishwasher will become as important an electric utility as the washing machine or vacuum cleaner. Many women who do their own work employ others to take care of the laundry or housecleaning, but all perform the disagreeable task of washing dishes three times a day. Hence the dishwasher makes a special appeal to the actual buyer of household devices. In restaurants, hotels, etc., an efficient dishwasher will quickly save its cost in time saved and breakage prevented. The Walker motor-driven dishwasher has recently been perfected and is claimed by the manufacturer to do thoroughly satisfactory work. The illustration (from an actual photograph) shows a sectional view that makes clear the principle of operation. The dishes are placed in wire trays; the container is partly filled with hot water, and soap is added. At the bottom of the container is a dasher which is rotated rapidly by a Westinghouse Electric small motor and forces the water up, between and over the dishes, washing them thoroughly in a few minutes. The dishes are not merely sprayed but are swept by solid waves of water. Since the trays do not move, there is no danger of breaking the dishes. The container is of heavy metal which has a grease-resisting and free cleansing surface. The bottom is conical so that drainage is perfect. The washer is supplied for wall mounting (as shown) and in a portable type and is made in three sizes for home, restaurant and hotel use. It is manufactured by the Walker Bros. Company, Syracuse, N.Y.

Small Dish-washer.

A New Electric Radiator on the Market

The McDonald Hydro-electric Heating Company, Limited, 77 Metcalfe Street, Ottawa, after two years of experimentation and testing, are now placing on the market the result of Mr. McDonald's inventive genius—an electrically heated portable hot water radiator. In this radiator a minimum quantity of water is spread over a maximum surface, so that the greatest number possible of heating units are transferred with the lowest possible amount of electric current consumption. So successfully has this system been worked out, that it is claimed by the company that the heating of our homes is within the reach of all.



Hydro-electric Radiator.

It would be too much to expect that in one stride electric heating could be made to compete in price with our coal heated water or steam radiating systems but the figures obtained at 77 Metcalfe Street during the last two years indicate that a condition of comparison is at least being approached. For example, the total cubic foot capacity of the offices of this company is 19,652 and the average cost of

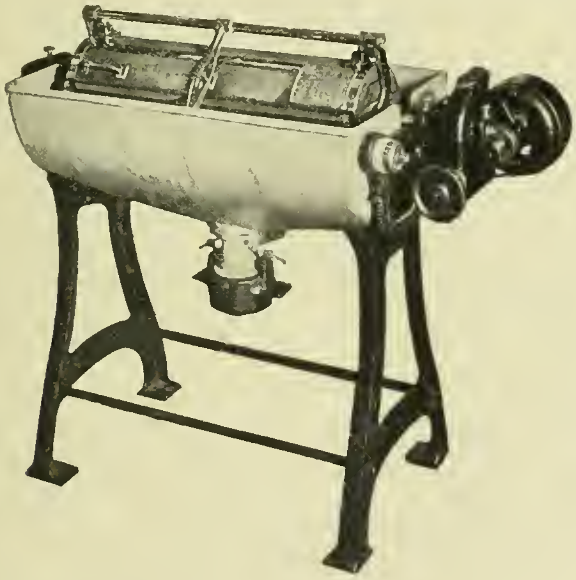
den which the employers have had placed upon them has led heating this building to an average temperature of 68 deg. F. for the month dating from November 17th to December 16th, 1914, was at the rate, in Ottawa, of 2 2-3 cents per hour. This certainly indicates very promising possibilities for this range, for the past month has been the coldest for this season in many years and Ottawa is one of our coldest cities.

This stove is just being placed on the market, having received the approval of the Fire Underwriters' Association and the Hydro-electric Power Commission of Ontario. One of the units is illustrated herewith, though the picture does not give an accurate idea of the extreme thinness of the so-called "coils." In appearance the radiator is not unlike the newer type of steel hot water radiators that are gradually making their way into the market.

Electric-Driven Silver-Burnishing Machine

The machine shown herewith consists of a wooden cylinder which is three-quarters filled with smooth, highly polished steel balls, varying from about 1/4 inch diameter to about the size of a very small pin head. In addition there are also a number of smooth, blunt slugs. Steel plates divide the cylinder into several compartments for different classes of silverware. The machines are made in varying sizes, and are driven by 1/8 to 2 horse-power motors, made by the Robbins & Myers Company, Springfield, Ohio.

To operate, the silver is placed in the cylinder with the steel balls, and is covered with hot soap suds. The current



Motor-driven Polishing Machine.

is then turned on and the machine is allowed to operate for about ten minutes. By centrifugal force, the pieces of silver are moved to the centre, and the steel balls roll over and around them, while the steel slugs penetrate fret-work and crevices that even the smallest ball may not enter. The silver is cleaned, burnished and sterilized. In addition to saving time and labor it is claimed that this machine will burnish the most inaccessible places which cannot be reached by hand, and that it also removes the disagreeable odors which are so difficult to remove from silverware which has seen some months of hotel service. The machine was just recently placed on the market by the Tahara Company of America, Philadelphia, Pa.

Keith's, Limited, Toronto, have been awarded a contract for switchboard equipment and switchboard platform for the new Central Technical School, Toronto. This will be one of the largest switchboard installations in Canada.

Meeting of Westinghouse Agent-Jobbers

The midwinter meeting of the Westinghouse agent-jobbers was held at French Lick Springs, Indiana, December 3, 4 and 5. The object of the association is to promote close relations between the manufacturer and the agent-jobbers, with a view to providing more efficient avenues for distribution of electric appliances, and to popularize the use of electrical apparatus and supplies to the end that the purchase of such articles may be made easy and convenient for the ultimate user.

New Books

Automatic Telephony—by A. B. Smith, E.E., Mem. A.I.E.E., and W. L. Campbell, E.E., Fellow A.I.E.E McGraw-Hill Book Company, Inc., New York, publishers; price $4.00 net. This book endeavors to meet the demand created by the now world-wide interest in automatic telephony and a very general demand among telephone engineers for a more extensive knowledge of this subject. It is the first publication devoted exclusively to automatic and semi-automatic telephony. The authors have described fully typical circuits and apparatus of each of the more important or instructive types on the market, but have found it necessary to confine their discussion of certain subjects to the practice of only one manufacturer. Wherever this has been the case, the practice of the Automatic Telephone Company has been followed, the authors stating their belief that the principles and methods brought out in these chapters are sufficiently applicable to other makes of equipment to supply the wants of students of the general art. Bound in the standard form of this publishing house and well illustrated; 400 pages.

Heated Entirely by Electricity

(Concluded from page 32)

them to take a much greater interest in the welfare of their employees and has put them in touch with many conditions which were unknown before. Until recent years no special effort has ever been made to fit the work to the man but it has usually been a case of fit the man to the work. The requirements of the compensation laws have given the employer a new incentive and that is to try to see that he has workmen physically able to perform the work for which they are engaged. To this end many of the employers of labor throughout the country have adopted the policy of medical examination which is believed will prove to be of untold benefit to employer and employee alike. It does not mean that the man who is not physically perfect will be shut out or prevented from obtaining employment, but it does mean that more care will be used in the employment of labor and that an effort will be made to place the man at the kind of work which he is physically able to do rather than to place him at the kind of work which he thinks he wants to do but for which he does not know he is physically unfit. Such procedure is bound to be beneficial to both parties because it will tend to improve the efficiency of the employee, thereby benefitting the manufacturer; it will tend to conserve the life and health of the employee, thereby enabling him to perform his duty to society; and by lengthening out his life it will extend the period of his usefulness to his family and the community. Society has much to be thankful for when we consider the amount of suffering and distress that is going to be saved by reason of the enactment into law of the principle of compensating workmen who are injured in the performance of the work incident to their employment and in the years to come the employers and employees will wonder why such a blessing to mankind was not brought into existence many years before.

Current News and Notes

Birchcliffe, Ont.

The Scarboro Township Council are asking the provincial Hydro-electric Commission for a report on the cost of installing a distributing plant for lighting Birchcliffe and Kalmar Heights.

Brantford, Ont.

The Brantford Municipal Railway System has been further equipped with six new p.a.y.e. cars supplied by the Preston Car and Coach Company, Preston, Ont. The inauguration of this important service was attended with considerable ceremony.

Chatham, Ont.

The City Council of Chatham are receiving petitions for extra lighting installations from the ratepayers on various streets of the city. It is stipulated that in every case the lamps are to be placed 200 ft. apart and to consist of 100-watt units. It is the intention of the council to keep the maintenance of the street lighting system within the sum of $13,000.

Chatsworth, Ont.

A by-law will be submitted authorizing the council to submit a by-law, asking authority to negotiate with the Hydro-electric Power Commission of Ontario for a supply of Niagara power.

Delaware, Ont.

A by-law will be submitted on January 4th asking authority to close a contract with the Hydro-electric Power Commission of Ontario for a supply of light in this village.

Dundalk, Ont.

A by-law will be submitted on January 4th, authorizing the Village Council to expend $5,000 on the erection of a distributing electric plant to be served from the lines of the Hydro-electric Power Commission of Ontario.

Galt, Ont.

A by-law will be submitted on January 15th in connection with additions to the fire alarm system.

A part of the new street lighting has been turned on on Main Street. This is an ornamental single unit system, nitrogen tungstens being used throughont.

Kamloops, B.C.

The new hydro-electric plant at the Barriere River was placed in operation during the second week in December.

Now that the new hydro-electric plant has been placed in operation, the city of Kamloops has a surplus of power available temporarily. It has been proposed that the local government undertake the distribution of this power to various agricultural districts in the neighborhood, where considerable quantities are required not only for light and power around the buildings, but also for irrigation purposes.

Kingston, Ont.

Permission has been granted to the Gananoque Electric Light & Water Supply Company, Limited, to enter the city of Kingston with their power lines and supply power to the flour mills of the Canadian Milling Company.

London, Ont.

It is understood that the Hydro-electric Power Commission of Ontario will prepare an estimate of the value of the London Street Railway Company, and that a by-law will be submitted to the electors at some date early in the new year not yet fixed, authorizing the city to purchase the system.

Montreal, Que.

For the fiscal year ended October, the gross earnings of the Kaministiqia Power Company totalled $327,109, an increase of $24,368 over the previous year.

The offices, switchboard gallery, generating and transformer houses of the Cedars Rapids Manufacturing and Power Company are all being heated by electricity. The National Electric Heating Company, Toronto, supplied the units. These are of 5, 10 and 15 kw. capacities.

The Cedars Rapids Manufacturing & Power Company will commence operations on a commercial basis early in the new year. So far seven units have been tried out, and the line to Massina, N.Y., where most of the power will be utilized, is practically completed. This is another aluminium transmission line, the material for which was supplied by the Northern Aluminum Company.

Mr. C. H. Cahan, of Montreal, president of the Western Canada Power Company, is now in England in connection with the proposed sale of a further $1,000,000 bonds of the company. The proceeds of this sale will be required for the company's financing next year. It is stated that most of the machinery for the third unit has been purchased and paid for, and will be installed in the early part of next year. The installation of the fourth unit next year will depend upon the demand for power.

A Safety First League, composed of the publicity utility corporations, is being formed in Montreal. Those comprising the league will probably be the Bell Telephone Company, Montreal Tramways Company, C. P. R. Telegraph Department, G. N. W. Company, Westmount Corporation Light and Heat Department, Montreal Public Service Corporation, and Montreal Light, Heat and Power Company. It is proposed to take measures to guard against accidents, and to work on the lines of a similar league formed in Hamilton, Ont.

By 176 to 159 the members of the Montreal Board of Trade have reaffirmed a resolution that the City and Montreal Tramways Company should take immediate steps to extend the franchise of the company on a fair and equitable basis. The opponents of this resolution argued that the present time is inopportune, and that a commission of experts, chosen by public bodies, should be appointed to report on the whole question. The meeting was very crowded, and the discussion animated. The Montreal Builders' Exchange have also passed a resolution in favour of a speedy settlement of the question.

Ottawa, Ont.

Notice has been given that the Niagara-Welland Power Company will apply to the Parliament of Canada at its next session, for an extension of time within which it may complete and put in operation the works of that company.

Peterborough, Ont.

The services of Mr. Wm. Kennedy, Jr., of Montreal, have been engaged to investigate thoroughly the advisability of installing a steam auxiliary plant for the town.

Port McNicholl, Ont.

Power was turned on at this point on December 17th. The town has contracted for some 30 street lamps. Power is obtained from the Severn River plant of the Hydro-electric Power Commission of Ontario.

Simcoe, Ont.

Foray & McCall are opening show rooms at 60 Peel

Street where they will carry on a business of electric dealers and contractors.

Thornhill, Ont.

The ratepayers are discussing the question of better street lighting and a by-law may be submitted at the January elections.

Three Rivers, Que.

Messrs. J. T. Desilets & Cie, electrical dealers. Three Rivers, Que., have dissolved.

Toronto, Ont.

Until such time as a permanent shelter can be provided by the Toronto & York Radial Railway Company at their Sunnyside terminus, one of the regular coaches lighted and heated, will be provided for the convenience of the waiting public.

It is estimated that the Toronto Hydro-electric System will have a surplus for the year 1914 of approximately $100,000. In spite of the generally recognized unsatisfactory trade conditions, customers have been added to this system at the monthly rate during the past year of about 800.

The Great North Western Telegraph Company and the Canadian Northern Telegraph Company are said to have made arrangements whereby after January 1st, 1915, both companies will be operated under the name of the Great North Western Telegraph Company. It is further reported that the lines of the Western Union Telegraph Company will be taken over by the Great North Western Telegraph Company. This will then comprise the largest telegraph system in the Dominion, with approximately 1,700 stations.

Vancouver, B.C.

City engineer A. M. West has submitted a report to the Municipal Council of North Vancouver, covering ornamental street lighting from Ferry Wharf to First Street, by single unit standards. The lamps recommended are 300-watt nitrogen tungstens.

The Western Canada Power Company will, it is understood, offer for sale $1,000,000 additional bonds, the proceeds to be used in completing the purchase and installation of a further unit for their plant at Slave Falls, Ruskin, B.C. The third large unit is at present in course of erection and, if conditions warrant, the fourth and last unit of the first plant will be installed during 1915.

The annual report of the directors of the British Columbia Electric Railway Company for the year ending June 30th, 1914, has just been published. Owing to adverse business conditions in and around Vancouver, the earnings of the company were smaller than usual, and, though the regular dividends have been declared, it was necessary to withdraw some $50,000 from the reserve account of former years.

Victoria, B.C.

The well-known firm of Carter & McKenzie, electricians and contractors, Victoria, B.C., haye taken over the premises and stock of the Hinton Electric Company, 911 Government Street. The Carter & McKenzie Company started in their present line of business some three years ago, and as indicating the rapid development of their business, it may be mentioned that they have under way at the present time a complete electrical equipment for the new half-million dollar Drill Hall; the new City Hall, a $100,000 building; and a complete underground distribution system of light and power for the grounds and outbuildings of the palatial residence of the Honorable James Dunsmuir, Hatley Park. The same firm recently completed the electrical installation of the new Provincial Jail, near the City of Victoria.

Welland, Ont.

A by-law will be submitted to the ratepayers on January 4th, authorizing the expenditure of $5,000 on a fire alarm system.

The Town Council has accepted the offer of the Niagara Falls, Welland & Lake Erie Railway Company to pay $60,250 in twenty years towards the cost of street paving. The council also gave their formal permission to allow the Railway Company to cross the Canal Bridge at Main Street to connect up with the west side extension.

Westmount, P.Q.

The net profit of $30,400 of the Westmount municipal electric lighting department for the fiscal year is the largest in the history of the plant. This profit is after the deduction for interest, depreciation and sinking fund. The result is due, according to Alderman Graffety, the chairman of the lighting committee, to the excellent management of Mr. G. W. Thompson, manager, the Council, and the loyalty of the citizens to their own plant. The profit is turned into the depreciation account, which now amounts to $147,000 and from that account the money needed for improvements is voted and replaced by bonds. The sum of $25,000 will be taken from the fund for the extension of the new lighting system.

Winnipeg, Man.

The Public Utilities Commissioner, Judge H. A. Robson, is considering the advisability of requiring the Winnipeg Electric Railway to make certain changes in their operating schedule. Among the suggestions are the location of stopping places at standard distances of 500 ft. apart, irrespective of whether these points are at street corners or not; loop tracks at vantage points all over the city or stations holding emergency cars to be used to assist in maintaining the schedule where the regular cars are delayed. It is also suggested that a signal system be installed so that the police who are regulating the traffic may be in constant communication with one another and so minimize delays.

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The Jordan River Plant

The detailed description of the Jordan River plant, owned by the Vancouver Power Company, a subsidiary of the British Columbia Electric Railway Company, is only one more evidence of the faith of this company in the ultimate great prosperity of the province of British Columbia, and of their honest endeavour to have a prominent part in the pioneer development work that must necessarily involve a heavy expenditure in both capital and labor before satisfactory operating results are possible.

The attitude of the B. C. E. R. Company throughout is surely entirely worthy of the commendation of all Canadians. As we have suggested on more than one previous occasion it is impossible to conceive of the progress of Vancouver and the surrounding district as exemplified during the past eight or ten years, without the constant co-operation of some such force as the B. C. E. R. Company has been. At no point on the American continent probably is there to be found a city of the size of Vancouver with as complete a network of electric railways threading its suburbs and connecting outside points. To an onlooker the assistance rendered to the City of Vancouver and adjacent municipalities by the B. C. E. R. Company has seemed almost prodigal and yet no doubt it was part of a well conceived progressive plan to develop the district as rapidly and as thoroughly as possible.

And this is true not only of the railway system, but also of the generation of power. The generating plants which supply the power to operate the railways as well as for illumination and power in home and industry throughout a very wide area, are among the most famous in the world, both in architectural and mechanical design. Further than this the big water plants are backed by the most modern steam standby plants so as to give the greatest possible assurance not only of good service, but of good service all the time.

Following the same liberal policy the Vancouver Power Company have built plants on Vancouver Island for the supply of energy to drive electric cars through the streets of Victoria and over a wide suburban area; also to supply light and power for the home, the street and the factory. The latest achievement is the installation of an 8,000 kw. unit at the Jordan River plant, the third unit to be installed there, and where all the experiences of modern manufacturers and engineers have been brought to bear to make the plant as useful and as efficient as it can be made.

Every Canadian must regret the conditions which temporarily have rendered it impossible for the parent company of all these enterprises to do little more than earn operating expenses. This in itself, however, is one of the best proofs of the liberal policy of the company towards the public it has tried so hard to serve efficiently. We predict that the early return to normal conditions in our coast province will be materially assisted by the ample supply of power that this company is in a position to offer, even as this factor has so largely aided in the almost phenomenal developments of the past.

Reclaiming Land by Electricity

Another evidence of the progressiveness of "the west" is given in an article published elsewhere in this issue on the subject of "Reclaiming land by electrical methods." In this article is told the interesting story of how some 45,000 acres of rich land have been reclaimed by the application of a little science combined with a fair proportion of common sense—and this, too, in a province where land is thought (in the east) to be plentiful enough already. It illustrates well, however, the inclination and ability of the westerner to improve on nature if nature doesn't suit him, and it further shows that the powerful factor—probably the determining factor in this great work—was electricity. That the demands made upon the pumps is very great is shown by the fact that in one particular area of 8,400 acres, about one-sixth of the whole, the rainfall per day amounts to an average of 42,000,000 gallons.

The most interesting point made in the paper probably is that the cost of pumping per hour by electricity is just about half what it would be with steam. Even this figure, the article states, does not put the best complexion on the results, as the interest on capital costs is considerably less with electrical than with steam equipment—which means, of course, also that the capital expenditure is less in the first instance.

Cleaning Streets by Vacuum Process

Since the advent of the electric sweeper for the home and office, the suggestion has frequently been made, and from time to time given spasmodic try-outs, that our streets could be cleaned in a more expeditious and sanitary manner by the use of large vacuum sweepers.

Such a sweeper is described in our present issue. It is, in appearance at least, a somewhat cumbersome machine, but experience will soon show where improvements can be made in this and other respects. This sweeper is driven by storage batteries throughout, which, in that they admit of perfect control both of the speed of the machine and of the motors which operate the sweeper and elevator, have been chiefly the means of making the idea practical and commercial. The same article describes briefly a somewhat similar storage battery operated wagon to be used in collecting city garbage.

Electrical Developments During 1914

Progress in things Electrical in Spite of General Depression—Refinements Rather than Inventions—Increasing Forms of Application

In spite of the business depression prevalent during the year just passed there has been a considerable advance along electrical lines. This progress, however, has been confined to extensions of existing standards and lines rather than any new or startling discoveries or inventions.

President Paul M. Lincoln of the American Institute of Electrical Engineers in a recent review of the year 1914 has the following to say in regard to electrical progress:—

"One thing that is perhaps most noticeable to one who has looked over previous reviews, is that progress, particularly in things electrical, may now be taken as a matter of course. If there is any branch of our industry which does not show progress, it is an immediate sign of decadence. If progress in any given line cannot be reported for this year, it is very probable that next year's progress will omit mention of it entirely."

The gradually increasing size of generating units has kept pace this year until we now look with the utmost complacency on the installation of a 35,000 kw., turbo-generator, whereas a few years ago we marvelled at a 10,000 kw. set as reaching the limit in the way of size. The growth in size has been a regular and normal one due entirely to the demand for large and more efficient units to take care of the rapidly increasing use of electricity in the home, office, store, factory, and farm.

For example, there is now being installed for the Brooklyn Rapid Transit Company, a 30,000 kw. "double" unit. Closely akin to the increasing size of the generating units is the continued growth of high-tension voltages for transmission purposes, as exemplified by the Pacific Light & Power Company in California which uses 150,000 volts. These transformers, reported in 1913, still hold the record for a high voltage commercial installation.

An interesting development in connection with this latter plant is the use of automatic voltage regulators on both generating and receiving ends, thus maintaining constant potential at both points, the regulators on the latter being used with synchronous condensers.

Transformers of the self-cooling type are now being built up to 5,000 kv.a. capacity, of sheet steel, equipped with external radiators, made oil-tight by the oxyacetylene welding process. The air blast transformer has also reached a maximum size in a 5,500 kv.a., single-phase unit in 25-cycle service.

The Portable Transformer

A new development is the portable transformer sub-station consisting of a car 10 feet wide x 35 feet long having mounted thereon three oil-insulated, self-cooled transformers with high and low-tension switching equipment, and having a capacity of 4,000 kv.a. This compact arrangement is made possible by a forced draft through ducts around the base of the transformers.

One of the most interesting applications of electrical material within the past year and one which has proven its economy and efficiency, is that of driving rolls in sugar mills by means of electric motor power. Not only has the material for this method of drive become cheaper than the Corliss engines formerly used, but installation costs have been less. It has been more economical in operation; expense in point of attendance and oil has been less, and annual charges heretofore necessary to completely dis-assemble, overhaul and re-assemble the engines are eliminated. The operators have also gained greater control and are in a position to better and more quickly vary the speed of the rolls, thus practically guaranteeing continuous service. The use of electricity in steel mills has continued.

A particularly noticeable fact is the adoption of central station power by the steel mills, coal companies and railroads for work in their respective lines, the latter two particularly for work at terminals. One company alone, at a rough estimate has furnished equipment during the past year that will result in an output by central stations of from 15,000,000 to 20,000,000 kilowatt hours of energy for this class of service, assuming normal business conditions.

Electric Furnaces

A number of steel companies have installed electric furnaces, indicating an appreciation on their part of the ease of application and accurate control as well as other advantages of this latter electrical development.

During the past year the railroads, steel foundries, steel mills, and machine shops, in particular, have taken quite an active interest in the subject of arc welding. A very considerable saving is effected by its use, and the advantages of this apparatus are just beginning to be appreciated. Undoubtedly, there is still a wider field for its use. Different companies have been actively engaged in the development of this proposition. The railroads at present are the principal users.

In industrial lines the development has been mainly along the lines of refinement, particularly in reference to the control. For example, during the past year alternating and direct-current magnet switches, automatic starters and controllers for use with various industrial applications, and improvements in reversing motor planer equipments have been placed on the market; also extended lines of industrial motors including the polyphase and single-phase types, elevator motors, blowers of the Ventura type, and direct traction elevator motors and control which latter is meeting with marked success.

Circuit Protection

In the case of switchboards, progress has been made in the protection of circuits by means of improvements in relays and circuit breakers. An induction type relay operating on watthour meter principles that obviates troubles experienced with the bellows type has been brought out. This relay has a self-contained torque compensator giving inverse time element on ordinary overloads, and definite time element on heavy overloads, or short circuits.

A direct trip attachment has also been developed so that a circuit closing relay of this type can be used with a circuit-breaker tripped from a current transformer, where no shunt trip circuit is available. This attachment, which can be built for circuit breakers already installed, consists of an auxiliary magnet which prevents the tipping plunger of the circuit breaker from operating until the relay contacts close.

In the design of oil circuit breakers themselves no very great changes have occurred, but the year has seen much progress along the lines of following out the great improvements which were commenced during 1913. The principal advance has been in the use of one-piece cylindrical tanks with round bottoms for circuit breakers of heavy capacity, this obviously being the very strongest type of tank which it is possible to obtain.

During 1914 several 24,000 ampere carbon type circuit breakers were put into service, these being the largest capa

city circuit-breakers of any kind ever built. Outdoor oil circuit breakers can now be obtained for any voltage from 13,000 to 165,000 electrically operated, at reasonable prices and in entirely self-contained units for automatic operation and at the lower voltages with self-contained inverse time limit overload.

Meters

The introduction of the reactive factor meter in place of the power factor meter, in other words, the use of a meter to measure the sine of the angle of lag or lead instead of the cosine, was made during the year. The matter is the same in principle as the power factor meter, but it enables operators to keep the power factor closer to unity than can be done with the older instrument.

A distinct advance has been made in metering electric energy by the introduction of a watt-hour demand meter, thus catering to the demand of students of electric rates who insist on including the demand as well as kilowatt hours consumed. A demand meter that has neither clock, motor, nor timing device, contacts nor solenoids has been brought out. It is self-contained and of about the same size as an ordinary meter, and contains a secondary disk, in the same magnetic field as the main disk, which is controlled by an escapement wheel and clog. A pointer connected thereto indicates the highest watthour demand for the given period of time.

The year 1914 has also seen a great development in the use of two rate meters, as many supply authorities now appreciate the sound policy of lowering their rates for "off peak" loads. This development has been very largely assisted by the introduction into this country of a two rate meter with a perfectly accurate recording train, the forms obtainable until this year having been such that in changing over from one rate to another, an impulse was given to the train without any current being consumed. A further improvement in the mechanism which is now obtainable is that a time switch can be obtained which only requires winding once every five weeks, and the clock mechanism itself is so accurate that adjustments are not necessary from one year's end to another.

A fault localizer just brought out, new in application, but not new in principle, permits the ready and exact location of a ground in a cable circuit. It is a combination of a galvanometer and resistance forming a conveniently operated "bridge" for determining the location of the fault.

Continued use of commutating poles on rotary converters has proved their usefulness. A 4,000 kw., 600-volt, 25-cycle converter is now being built for the Interborough Rapid Transit Company in New York with a 300 per cent. momentary overload guarantee. A 2,000 kw., 270-volt, 60-cycle synchronous booster rotary is now being built for the Cleveland Electric Illuminating Company which will be the largest 60-cycle rotary of this type ever built.

The most notable feature about the above developments is the comparatively higher speeds that have been used over those formerly used. The use of commutating poles in the design of these machines has made not only this higher speed possible, but has produced better machines, it being particularly noted that the peripheral speeds of these machines are very little, if any, higher than the peripheral speeds used on the non-commutating-pole designs.

Compensated windings have been effectively used in addition to commutating poles on generators, where subjected to very severe peak loads such as in large flywheel motor-generator sets.

Synchronous Condensers

Probably the most recent developments in important apparatus have been the two 6,000 kv.a. synchronous condensers with regulating equipment supplied the City of Winnipeg, which have been so effective in reducing the line drop of their transmission system that they have greatly increased the capacity of their present transmission circuits. This will obviate the necessity of building an additional transmission line for some years to come. The Northern Ontario Power & Light Company have also recently installed four 1,700 kv.a. self-starting synchronous motors for driving air compressors, and also for correcting the power factor on their distributing system in the Cobalt distict. These synchronous motors are replacing 1,000 h.p. induction motors of the wound rotor type and the corrective effect on the power factor of the distributing system has been so marked that greatly increased transmission line capacity has been secured, as well as much better voltage regulation at the centre of distribution. The great importance of large synchronous motors for power factor correction and regulation is only beginning to be appreciated by operating companies, and this is an application which they should all investigate most thoroughly as it has great possibilities.

Motor Converters

In the Canadian field one of the most interesting features has been the introduction of the "motor converter," the theory and construction of which was dealt with in our issue of June 1st, 1914. The first set in Canada was started up in the early summer by the Regina Municipal Electric Department, this machine being of 1,200 kw. capacity, converting from 3-phase, 2,200-volt, 60-cycle, to 550/600-volt d.c. Since that date the Canada Cement Company, of Monteral, have installed a 250 kw. set, and the Armstrong Whitworth Company have installed two 350 kw. sets. There is also on order a 600 kw. set for the city of Saskatoon, but this has not yet been delivered.

The largest machine of this type so far built has just been installed in the Manchester Corporation Electric Works, this being 2,200 kw. capacity, converting from 6,500-volt, 50-cycle, 3-phase to either 420/460 volt shunt wound or 520/550 volt compound wound, the arrangement on shunt being for three wire balancing while the compound connections are of course used on traction system.

Devices and Fittings

During the past year a number of new and original devices and fittings have been developed. For example, the porcelain portion of the bus bar insulator supports of a certain manufacturer is designed with thin and deep corrugations, and along the lines of properly distributing electrostatic stress over the insulator. The proper amount of attention has not been given in the past to this very important feature in porcelain design. All insulators of this type, both for use as bur-bar insulators and on this line of disconnecting switches, are tapered. The same company have also brought out a new line of insulator pins, malleable iron switchboard panel and pipe fittings; also a new line of clamp type supports for mounting on pipe and also on flat surfaces. The support for mounting on pipe is arranged in such a way that the same casting is used for any size of pipe from ¾-in. to 1½-in. and also for mounting directly on flat surfaces.

All modern high capacity plants are putting locking devices on their disconnecting switches to prevent the switch opening in case a short circuit enters the station. There has been developed a very novel interlocking lock, arranged in such a way that the operator cannot remove the switch hook unless the switch is either in the open or closed position.

Fuses

Regarding developments in fuses during the past year, a large United States manufacturing company writes:—

"We are pleased to call your attention to our new oil fuse cut-outs which practically every central station is vitally interested in. Until this device was put on the market practically the only form of transformer protection was the ordinary plug cut-out or the enclosed fuse installed in an iron box. Neither of these were absolutely satisfactory especially

when fused above 15 or 20 amperes. This is especially true when intsalled on power circuits. The result upon the blowing of a fuse on short circuit with either of the mentioned cut-outs was usually that of entirely destroying the block. This is not only dangerous but costly and generally unsatisfactory.

"With the use of the oil fuse cutout capacities up to 5,000 kw. can be satisfactorily handled on dead short circuits without in any way injuring the device. Furthermore the fusing can be safely and quickly accomplished by the linemen under all conditions.

"The cost of these cut-outs is very reasonable and in consequence central stations can now provide an accurate and safe form of protection for their transformers and junctions, with a small expenditure."

Water Turbines

In the water turbine field there have been no radical developments. A prominent Canadian manufacturer reports "just a gradual evolution towards our goal, the ideal turbine water wheel," and adds,—

"Do tell the public to enquire thoroughly into the merits of normal speed—normal discharge turbines before sacrificing half and sometimes all the practical value of their water powers on the altar of high speed. Is it not most reasonable that the 'Happy Medium' between 'Slow Speed' and 'High Speed' turbines should have the greatest staying powers and best working qualities?"

In the Automobile

The use of electricity in the automobile is one of the modern developments which has grown rapidly. At first, the only use that electricity found in the automobile was for purposes of ignition. However, the convenience of electricity has won over the automobile field in a remarkable manner in the past few years. In these modern days, no automobile is complete unless the gas engine charges are electrically ignited, and it is equipped with electric light and an electric motor for starting the engine and electric devices for shifting the gears, and doing many of the things which formerly were done by some other means. These, of course, are not entirely developments of the past year, but the past year has shown its fair share of the refinements in this particular development. The single machine with a single armature and single commutator which may be used either as a motor for starting the engine, or as a generator for charging the storage battery, is a development of the year. Further, the idea of making the electric unit entirely self-contained is one of this year, as a self-contained unit has been produced which comprises a motor, a generator, a distributor and the necessary induction coils, etc., for the ignition. Another development is the magnetic pinion shift wherein the starting motor is thrown in gear by means of a magnetic device instead of a manually-operated device as in previous years. It is surprising how completely the electrical equipment has won over the automobile field in recent years. There seems to be no question but that electricity not only has come to stay, with the automobile, but has come to be developed to a much larger degree in the future of this vehicle.

Lighting Fixtures

Another development of the year is along the line of Canadian manufacture of electric fixtures. One company advise us that they have kept a full staff of men employed up to the present time, that the success in this department has been very gratifying, and that during 1914 they have increased their staff in this department from a dozen to sixty employees. This company keep a staff of artists busy making designs for special inquiries, and during the past year have supplied fixtures for a great many churches, banks and public buildings. They say that the outlook for 1915 is very bright.

In house and office lighting very considerable progress has been made towards a more general use of semi-indirect and purely direct illumination. The prejudice against the appearance of these fixtures is gradually wearing off, and this, combined with the general recognition of the better physical conditions under which one works, is greatly assisting in increasing the number of installations of either direct or semi-direct. In Canada no concerted action has yet been taken towards educating the public into the proper use of illumination and in the evil effects which may result from bad lighting, but, in a general way, conditions may be said to be considerably more favorable and the field is doubtless ripe for some real progress during 1915. Not only is this true of the home and office, but also in larger public buildings, such as halls, churches and factories. The science of proper illumination is little by little winning its way over the desire for an excessive amount of light.

Gas Filled Lamps

A tremendous advance has taken place in the manufacture of light sources resulting in the production of nitrogen and argon filled incandescent lamps. The low cost of installation, the complete control of the light by suitable reflectors and the small attendance charge, together with the elimination of pencil carbon or electrode replacements, and the long life obtainable gives the gas filled lamp a leading place for street lighting. Many devices have been developed for housing the lamp and protecting it, yet at the same time preserving its luminous efficiency. One of these devices has been so constructed that in the event of the purchaser wishing to replace the lamps with those of a larger or smaller size, fittings may be supplied which will convert the original unit into one suitable for the other lamps and these changes may be effected at a very small expense. These units have been specially designed for series burning as well as multiple burning high efficiency lamps and are adaptable for indoor and outdoor service. They are made to exclude insects and to prevent sleet, rain or snow from reaching the lamp, yet providing ample ventilation and in no way materially decreasing the luminous efficiency of the lamp itself, whether operating in a series film socket, mogul socket or a socket of regular medium Edison base design, steel enamel or matt aluminium. Bowl and flat steel enamel reflectors are supplied and the latter do not interfere with the enclosing globes.

Possibly one of the most pronounced developments of the year has been the increased use of tungsten lamps for street lighting purposes. Until recently, the arc lamp had a monopoly of the street lighting field. It has labored under the disadvantage of a rather high upkeep, the necessity for recarboning and a somewhat flickering light. All of these shortcomings are overcome by the tungsten lamp whose advantages are sufficient to have caused it to be used to a very considerable extent for street lighting purposes, and its popularity in this use appears to be extending rapidly.

This has led to the adoption of new fixtures for use with these new street lighting units, a number of complete lines for both multiple and series lamps, having been brought out during the year.

In this connection may be mentioned the declining popularity of the ornamental group system of lighting and the introduction of the single unit standard. The appearance of the single unit seems to catch the popular taste and also the efficiency and distribution are more satisfactory.

Household Appliances

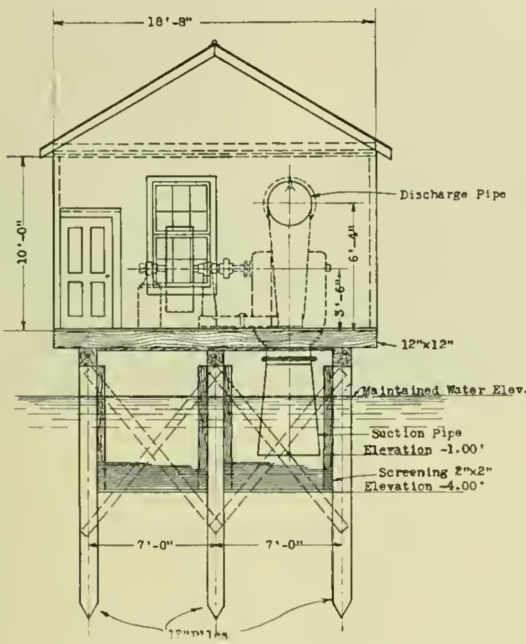
In the matter of household appliances, progress is noted in the increased number of manufacturing concerns now devoted almost exclusively to this kind of ware. The Canadian factories are apparently holding their own in this respect. Of the various types of equipment most progress has probably been made towards the development of an electrical

(Continued on page 32)

Reclaiming Land by Electrical Methods

A Wide Area of Rich British Columbia Fruit and Farm Land Made Available by Dykes and Electric Pumps. Comparative Figures Showing Big Gain Over Steam

IN British Columbia, where rugged mountains monopolize so much of the area, the valleys and the flat lands are in great demand for the uses of agriculture. Along the estuary of that great waterway of the province, the Fraser River, there lie extensive deltas silted up for ages with deep alluvial soil. Although these flats are unusually fertile the cultivation of them is not possible without dyking, as every year they would be inundated by floods. Of this rich land 43,126 acres have been reclaimed; earth dykes have been built, large pumping plants installed; so that now there are living on it hundreds of prosperous settlers. In Vancouver, twenty to forty miles distant from all sections, a nearby market is provided.



Front end elevation of pump house at Maple Ridge.

Although the land is privately owned, its reclamation is financed and administered by the provincial government. To look after this work a Department of Dykes was formed and placed under the superintendency of Mr. E. A. Wilmot. The initial cost of reclamation was met by the sale of 40-year 5 per cent. bonds. All annual expenditure for pumps and administration is defrayed by an acreage tax. This tax is levied upon separate districts according to the expenditure actually incurred in each, for by its topography the land naturally divides into six districts ranging in area from 1,125 to 19,000 acres.

Round each district is a dyke, following along the riverside and running into the higher ground inland. The first dykes were built twenty years ago, and since then others have been added. Steam-driven pumping plants were erected, but in time these proved to give insufficient drainage and were very costly to operate. In 1912, however, the government, realizing the desirability of increasing the settlement, decided to do so by improving the drainage, that the soil by being kept drier would be made fully productive. This entailed the electrification of the old steam-driven plants, and the building of new electric pumping stations. The additional outlay of money involved had to be carefully considered so as to prevent imposing a heavy burden on the settlers; for it should be borne in mind that the ultimate financial success of reclamation and of irrigation schemes depends to a large extent upon low pumping charges.

Dykes and Ditches

Ramifying throughout the flats of each district are large drainage ditches, which feed into a main ditch running alongside one dyke—the dyke, in fact, is formed of the earth raised in excavating the ditch. On the Fraser River this ditch is located between the dyke and the river, for with the ditch on the inner side of the dyke (as in the earlier Pitt River reclamations), the seepage through the dyke into the ditch is very considerable.

Here and there along the dykes a cut is made in which is placed a large flap gate. Through these gates the main ditch empties into the river. Thus the land is drained eight months in the year, the river level being lower during that period. But with the melting of the snows on the mountains in the interior the swollen rivers rise from ten to fifteen feet. This rise, beginning in May, is maintained throughout the four summer months. The problem to be dealt with then is the drainage of the land lying at a lower level than the river—the flap gates have shut back and drainage by gravity has become impossible.

The pumping plants have then to be started running, and by their operation night and day all summer the districts enclosed by the dykes are drained. The water is drawn by the pump from the main ditch and is conveyed into the river by means of a discharge pipe passing through the dyke.

Some idea of the large volume of water to be pumped off the Maple Ridge district may be formed by considering that, on its area of 8,400 acres, the monthly rainfall of 5.6 inches—as in June, 1913—is equivalent to 42,000,000 gallons per day. In addition to this precipitation there is the water coming from the higher lands behind the dyked area, and there is also considerable seepage through the dyke from the river into the ditch; these two additions, however, are offset more or less by the general evaporation from the land.

In pumping such a large volume it will readily be seen that a burdensome expenditure will be incurred unless cheap power is available, and unless care is taken to select economical pumping apparatus.

Electrical vs. Steam Pumping

For twenty years pumping was done by steam power but the high cost of coal prevented as much pumping being carried on as was required to keep the land in the best condition. Electrification was not feasible until two years ago when the transmission lines of the Western Canada Power Company, leading to Vancouver, were constructed near the dyked lands.

The advent of this cheap hydro-electric energy marked a new epoch in the cultivation of these re-

claimed lands. The dyking authorities immediately grasped the opportunity of utilizing this source of power to greatly improve the fertility of the soil. At the same expenditure incurred by steam power, double the pumping could now be done, the water in the ditches lowered by two feet, and the sogginess—with the resulting sourness—eliminated from the soil. The four old steam pumps were therefore electrified, and five new electrical pumping plants built. On these lands administered by the government there are installed 1,050 h.p. of motors on pumping duty. The economy resulting from the abandonment of the use of coal has proved most gratifying. The relative cost of operation may be compared in the Matsqui Stations, where two 200-h.p. motors now operate the old steam-driven pumps. The following table gives the cost actually incurred in the same stations, with approximately the same pumping results:

	1911 steam operation	1912 electrical operation
Cost of wages	$2,149	$ 807
Cost of coal	2,545	......
Cost of electric power.	......	1,039
Cost of supplies and maintenance....	211	144
Total cost of operation	$4.905	$1,990
Number of hours pumping.	1,413	1,107
Cost of pumping per hour	$3.47	$1.80

These figures, moveover, do not put the best complexion on the results of the electrification, for the interest on capital cost is now much lower than with the steam-driven plants; with the latter there is the engine and the boiler, as compared with only the motor in the new installations.

The success of this electrification is in no small measure the result of the effective manner in which the power company co-operated with the dyking authorities. It entered into a contract to supply the provincial government with cheap energy for all the reclamation stations, lending its engineers for supervising the alterations and for advising in the selection of the new machinery. Acting for the Western Canada Power Company, Mr. J. F. Cahan, their construction engineer, designed and personally superintended the building of these plants.

As an important element governing the design of the pumping stations, it should be mentioned that these have all been arranged so that the unskilled ranchers can safely operate them. This condition determined, in part, the choice of apparatus which would be reliable and be automatically safeguarded to the highest degree.

Priming the pumps is accomplished by means of a small air compressor with its connections reversed so as to act as a vacuum pump. By this arrangement the large casing of the centrifugal pump is sucked full of water in a few minutes. The vacuum pump is belt-driven by a 2 h.p. 220-volt, 3-phase motor, the low voltage being obtained from the two lighting transformers.

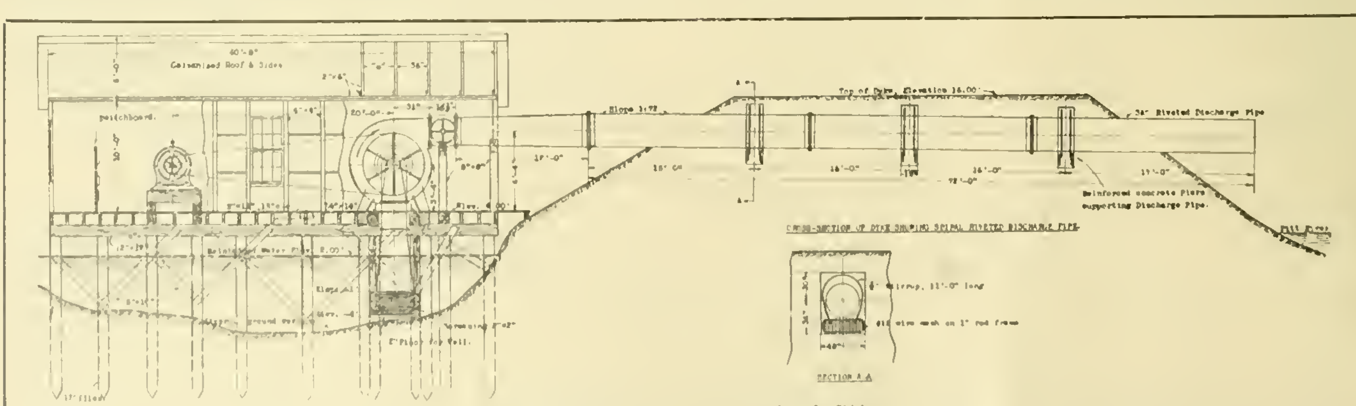
To supply these pumping plants with energy the Power Company ran along the dykes pole lines carrying 3-phase circuits of 2,300 volts, which is supplied direct to the motors without transformation. All wiring and switching arrangements inside the station are made simple and safe, so that skilled electricians are not required for operating the machinery. The motor used has a wound rotor, as this type gives the good starting torque required—for the pump, being primed at rest, is half-loaded to begin with, even although the closed gate valve prevents pumping. On gaining

Maple Ridge pumping station 100 h.p. motor—3 phase, 2,300 volts. 30,000-gal. Gwynne pump.

speed the rotor resistance is cut out step by step by a hand-operated switch, and on attaining full speed with the slip rings short-circuited the full load is applied by opening the gate valve and so allowing pumping to commence. The switchboard carries an oil switch connecting the incoming lines to the stator. To safeguard the motor against excess current a time limit over-load trip is attached to the oil switch, and furthermore, 2,300-volt cartridge fuses in the primary circuit are aided on the board. So that the building can be completely isolated, an oil switch operated by a rope line is located on the pole outside.

Pump House

As several different styles of pumping houses have been erected on the dyked lands, it will be of interest



Sectional elevation, pump house at Maple Ridge.

to describe the type of construction that the dyking authorities have now found by experience to be the most serviceable. What was wanted was a strong, durable, and above all, an inexpensive building that would properly house good pumping machinery. One of the accompanying illustrations shows one of these new pump houses; and it has to be remembered that the small ranchers whose taxes pay for these plants want merely a strong and neat building so designed that the pumps can be run as economically as possible. At such a pioneer stage economy, and not ornamentation, is the ruling factor. To fulfil these conditions it was found that the best arrangement was to build the pump house on piles driven into the ditch. While being amply strong, this construction has proved to be better than erecting on the adjacent land, where not only are concrete foundations necessary, but where considerable excavations have also to be made for the intake well.

The building is made of thick corrugated galvanized iron sheets covering a skeleton wooden framing, which is closely spaced and cross-braced. The overall dimensions are 40 ft x 19 ft. x 10 ft. The floor is placed as low down as possible, in fact only a few inches above the high-water level of the ditch; this allows the centrifugal to be placed where the pump should always be placed—down near its work, with as short a suction pipe as possible. The whole structure sits on 12 in. x 12 in. beams, which cap the twenty-four 12-in. piles. Attention may be called to the fact that these piles are rigidly braced together by diagonal ties, so as to prevent the structure receiving any vibration from the rapidly rotating machinery. The use of cedar piles has assured long life to these foundations.

The resultant effect of these pumping schemes has been to greatly enhance the value of the 40,000 acres of dyked land, so that it has sold as high as $500 per acre; at the same time, by the combination of cheap power with carefully chosen pumping machinery the annual dyking tax has been kept down to an average of $1.60 per acre; and in time this tax will diminish, as it is paying off not only the cost of the new electric plant, but also of the very expensive original steam stations.

Electric Street Sweeper Picks up Own Load

Couple-Gear Unit Uses Three-Wheeled Trailer Carrying Water Tank, Sweeping Brush and Belt Conveyors Which Deposit Sweepings in Body

Couple-Gear units for the purposes of street sweeping and for house-to-house collection of ashes and garbage and in both of which hand loading has been eliminated by the use of belt conveyors have recently been designed by the Clarence L. Smith Company, New York City agents for the Couple-Gear trucks. Both of the newly-designed units were invented by John Johnston of the Smith Company.

Street Sweeper Uses Trailer

The first of the two units consists of a Couple-Gear unit equipped with an ordinary dump-cart body and a three-wheeled trailer upon which is mounted a tank for carrying water to be used in laying the dust on the streets, a motor-driven sweeping brush and a motor-driven bucket conveyor which collects the sweepings from the brush and in turn elevates them to a point above the dump body into which it is deposited by gravity.

The trailer has its single wheel at the front, this being mounted within a fork similar to that used on the ordinary bicycle but much heavier, being made of wrought iron. The head of this fork is hollow to admit vertically a heavy pin. To connect the trailer with the truck, this pin is dropped through a slightly larger-sized hole in a wrought iron forked bar, the forward end of which is made in the shape of a hook to engage a similar hook attached to the rear of the truck frame.

The frame of the trailer is approximately 20 inches above the ground but is swept upward at the front end to permit of the turning of the front wheel.

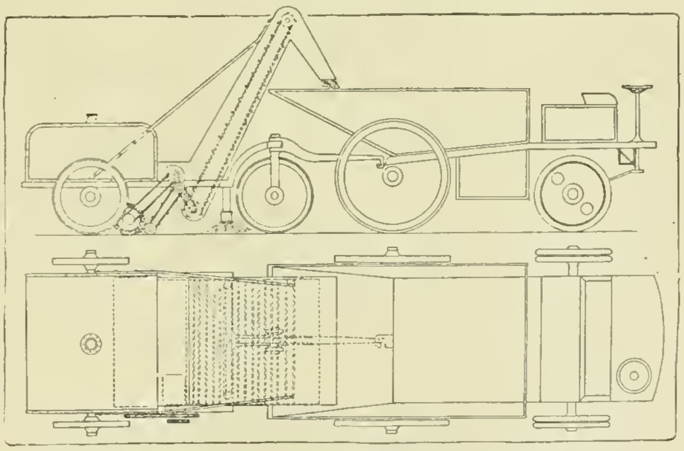
Sweeping Brush Is Not Rigid

The sweeping brush, which is made of cane bristles, is mounted just forward of the rear wheels of the trailer. It is carried on two rods which are attached to a circular disc on the driving shaft and which is free to move circumferentially, so that when passing over road inequalities it is free to move up and down, thus eliminating strains which it would have to withstand if rigid.

The sweeping brush is chain-driven from a 3 horse-power motor mounted on top of the trailer frame and inclosed within a dustproof container. The current for this motor is obtained from the storage battery which drives the truck by slack cables running along the frame of the truck, the drawbar connection and the upswept portion of the trailer frame.

Same Motor Drives Brush and Conveyors

The motor which drives the sweeping brush also drives the elevating machinery which transfers the sweepings from the ground to the body of the truck without any human labor.



Side and top elevations of street-sweeping unit showing the method of connection of three-wheeled trailer and the construction and method of mounting the two bucket conveyors which carry the sweepings from the street to the truck body.

Two bucket conveyors are employed to do this. The first raises the sweepings from off the brush to a pocket positioned below the trailer frame. The buckets of the second conveyor dip into this pocket and carry the sweepings to a point approximately 4 feet above the top of the body from where the material drops into it by means of gravity through a sheet metal chute extending to about 2 inches from the body top.

The first conveyor is gear-driven from the motor shaft which drives the sweeping brush but revolves in the opposite

direction from the latter. It is mounted in the same manner as the sweeping brush and follows the latter in passing over road obstructions, a small rubber-tired wheel being provided at its lower end which rolls along the ground and always keeps it in the correct relative position with the brush.

Upper Conveyor Is Chain-Driven

The second or larger conveyor is chain-driven from the shaft upon which is mounted the gear through which the smaller conveyor is propelled. It is entirely inclosed in a sheet metal covering, to the upper end of which is attached the chute which deposits the material in the truck body. Both conveyors consist of continuous canvas belts upon which are attached steel buckets at regular intervals. As may be seen in the plan view of the entire unit herewith, both of the conveyors are practically the same width as the truck or the trailer. This width is approximately 60 inches. The sweeping brush is the same length and about 20 inches in diameter. This measurement, however, may be changed at will to suit the particular conditions under which the unit may be worked.

The tank which carries the water necessary for wetting down the sweepings prior to being swept up by the brush is mounted at the rear of the trailer, its centre of weight being positioned directly above the axle of the rear wheels. From the tank the water is carried in two pipes along the sides of the trailer frame to a point directly aft of the front wheel, where they join in a vertical header which extends downward to within approximately 6 inches from the ground at which point it is provided with a perforated cap through which the water is sprayed over the entire area over which the sweeping brush passes. The capacity of this tank as at present designed is 300 gallons, although this may be changed to suit the conditions under which the unit is to work. The tank is filled through a 3-inch plug located in the centre of the top.

Truck Load 7½ Tons

The truck body designed for use with this unit is of the dump-cart type, 10 feet long on the top and 5 feet long on the bottom, the width at the top being 5 feet 9 inches and at the bottom,, 4 feet 9 inches. It has a capacity of approximately 7½ tons of ordinary street sweepings.

Three Advantages of Unit

The advantages of this type of street sweeping unit over the types in use at the present time are three-fold and as follows:

1.—It eliminates the human element heretofore necessary to load the sweepings into the truck for disposal and as dump.

2.—The trailer can be used in connection with three or four trucks according to the length of the haul to the dump being disconnected from one truck and attached to another as soon as the former is loaded.

3.—The elimination of the men usually required to load the sweepings will reduce the cost of loading per ton or per cubic foot.

It is also claimed that the entire operation of the truck will be cheaper per ton of refuse disposed than is possible with horse-drawn vehicles or with gasoline vehicles, due in the first instance to the greater mileage and in the second to the smaller daily operating cost.

No Trailer on House-to-house Unit

The second unit is designed for the house-to-house collection of garbage or ashes and differs from the one just described in that no trailer is used and in that the elevating machinery is mounted on the truck instead of on a trailer. It is made up of a Coupe-Gear unit, a covered steel body dumped by rack and pinion, a pocket at the side of the frame into which the material is dumped and a vertical motor-driven bucket conveyor which elevates and dumps it into the body.

Conveyor Takes Ashes from Pocket

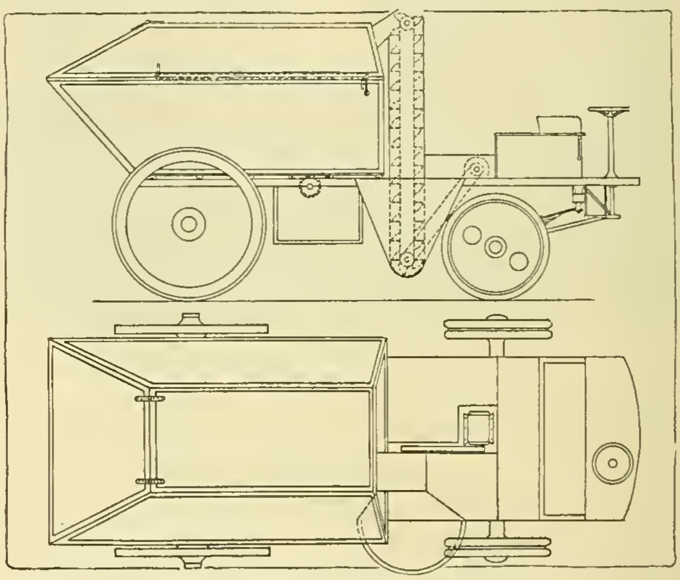
The conveyor is placed just forward of the front end of the body and extends approximately 36 inches below the frame and 72 inches above it. The conveyor construction follows that of the previous unit except that it is but 12 inches wide. Its lower end is placed in the bottom of the semi-cone-shaped pocket mounted on the right side of the chassis frame. The top of this pocket is flush with the top of the truck frame and extends outward approximately 20 inches.

As the material is dumped into the pocket it descends to the bottom where it is picked up by the conveyor buckets and lifted to the top of the conveyor from where it slides down a chute which extends through the cover of the body.

As in the previous case, the conveyor is chain-driven from a motor mounted on top of the frame directly aft of the driver's seat, and which receives its current from the battery which propels the vehicle. This motor is enclosed in a dust-proof box.

Hood on Truck Body

The truck body is of steel, 9 feet long at the top, 7 feet at the bottom, 65 inches wide at the top and 60 inches wide at the bottom. It is equipped with a cover in the shape of a hood, this being approximately 20 inches high and one-half the depth of the body. The hood is securely locked in place, not being removed when the body is dumped. This is accomplished through the rear end of the hood which is hinged at the top and which automatically opens as the body is in the act of dumping.



Side and top views of the couple-gear unit designed for use in the collection of ashes. The material is deposited in the cone-shaped hopper on the right side of the vehicle from which point it is elevated by means of motor-driven bucket conveyor and dumped into the closed body.

Due to the fact that the body is entirely closed except when dumping, some means had to be taken for distributing the material from beneath the elevator chute to the rear end of the body. This is accomplished by the use of a spreader consisting of two chains mounted on four gear wheels which are positioned on the ends of two crosswise shafts located at the front and rear ends of the body between the joint of the body and the hood, and several pieces of wood placed crosswise of the body and rigidly connected at each end to each of the chains. The spreader is arranged to be operated by means of a small hand crank mounted on the forward gear shaft, but can be electrically operated, if found necessary.

Material Distributed by Spreading

In operation, the wooden cross pieces shave off the top of the heap of material under the chute and push it back to the rear of the body until the latter is completely filled.

Jordan River Power Development

A Very Complete Description of the Engineering Features—Many Unique Conditions—8,000 Kw. Unit Just Placed in Operation

By Mr. C. A. Lee, Superintendent

On Vancouver Island, about thirty-six miles west of Victoria, there is located what is known as the Jordan River Power Development. This development is owned and operated by the Vancouver Island Power Company, a subsidiary concern of the British Columbia Electric Railway Company, which is the principal public service corporation of Victoria.

During the last two years several articles describing parts of this development have been published in engineering journals, but there has been no complete description of the whole undertaking, and it is the object of this paper to give a fairly full description of the development, together with a brief history of the work. Although the Jordan River Development is small as compared with many modern plants, it includes a variety of engineering work not common to even those developments of much greater magnitude, and it is believed that the more important features will prove of interest to many engineers. This development possesses another point of interest in that it is—so far as the writer has been able to learn—the highest head development of any considerable size in Canada.

Historical Data

The growth and expansion of the districts in and around Victoria, which are dependent wholly on the British Columbia Electric Railway Company for street railway service, light, and power, have been phenomenal, and the demand for electrical energy has been doubled and re-doubled several times within the past seven years. In 1907 power was being furnished by a 2,000 kw. hydro-electric plant at Goldstream and an 800 kw. steam plant in Victoria, but it was realized at that time that a material increase would be required in order to meet the demands of the near future. It was decided, therefore, to look into the available water-power possibilities within a radius of commercially feasible power transmission to the city of Victoria. This investigation was continued for over a year, and practically all of the sources of water power around Victoria were examined. The exploration was carried on only under exceptional difficulties. Within a very short distance of Victoria the country was practically unmapped and unexplored. The mountains and valleys are densely covered with a growth of heavy timber, both standing and fallen, and the underbrush is of such a nature as to make it almost impenetrable. These conditions can only be properly appreciated by those who have experienced them.

The preliminary snrveys of Jordan River were started the latter part of 1907, but on account of the winter setting in, it was impossible to finish this work until the following summer. A gauging station was, however, established near the mouth of the river and a series of records of rainfall and runoff were started.

In October, 1909, a party of engineers and a few workmen landed near the mouth of the Jordan River and established a temporary camp. This camp was used as a base while other camps of a more permanent nature were being built, and in a very short time construction work was started all along the line.

The original installation was completed early in 1912, but in the meantime the demand for power had increased so rapidly that work was started immediately on the installation of the second unit in the power house. This unit was put into operation in the fall of 1912, but the steadily increasing demand for electrical energy made it quite evident that still further extensions were necessary in order to keep abreast of the demand. The installation of the second unit marked the ultimate capacity of the initial development, and it was necessary, therefore, before making further additions to the power house, to increase the storage capacity of the system, enlarge the flume, and install about two miles of pressure pipe line between the forebay reservoir and the power house. The storage increase was obtained by the construction of the Jordan River dam, which was started in the summer of 1912 and in the spring of 1913 the construction of the addition to the power house was started. The flume and pipe line construction followed soon after, and the work was completed in October, 1914.

The Jordan River

The Jordan River flows into the Strait of Juan de Fuca at a point thirty-seven miles west of Victoria. The direction of flow is roughly from north to south, but the actual course of the stream is very tortuous. It is a typical mountain stream flowing in a deep and precipitous valley, and the fall is rapid from the source of the mouth. The source of the main river is in Jordan Meadows, which lie about midway between the east and west coasts of the Island, and at an elevation of about 1,700 feet above sea level. Several large creeks join the river within the upper ten miles of its course, the principal ones being Bear Creek, Wye Creek and Alligator Creek. The total drainage area is about 75 square miles, the greater part of which lies at an elevation of over 1,200 feet above sea level, and this entire area is covered by a growth of heavy timber.

The precipitation is heavy, probably averaging about 90 inches per year over the whole watershed. During the winter months there is a heavy fall of snow varying from 4 to 11 feet in depth in the higher parts. This snow, protected by the heavy timber and underbrush, often remains on the ground until well on in June or July, thus forming a splendid natural reservoir.

The total reservoir capacity of the system is 2,651,000,000 cubic feet which is divided among five reservoir sites as follows:—

Height of Dam	Location	Capacity Cu. Ft.
75 ft.	Bear Creek	607,000,000
125 ft.	Jordan River (Diversion point)	612,000,000
50 ft.	Jordan Meadows	980,000,000
50 ft.	Alligator Meadows	352,000,000
35 ft.	Wye Lake	110,000,000
	Total	2,651,000,000

At the present time only two of these reservoirs have been developed. A 57-foot dam impounds the water in Bear Creek creating a storage of 328,000,000 cubic feet, but this dam can be raised to the full height of 75 feet, when necessary, and the storage nearly doubled. The reservoir at the diversion point on Jordan River is developed to its full capacity. These two reservoirs provide a storage capacity of 940,000,000 cubic feet, which is sufficient for all present requirements.

General Plan of Development

The power house is located on the beach near the mouth of the river the centres of the water wheel nozzles being only a few feet above extreme high tide. Water is conveyed to the wheels from the forebay reservoir through steel pres-

sure pipe lines about 9,300 feet long. The forebay, which is a small equalizing reservoir formed by two earth fill dams, is 1,152 feet above sea level, giving a static head of 1,145 feet at the power house. Water is carried from the diversion point to the forebay reservoir in a wooden flume about 5.3 miles long, built along the east side of the Jordan River valley. A small dam in Alligator Creek diverts the water from that creek into a small flume which joins the main flume about a mile below the main diversion point on Jordan River. Wye Creek joins the river above the diversion dam. Bear Creek flows into the Jordan River about 3.5 miles above the main diversion dam, and the Bear Creek storage dam lies near the headwaters of that creek and about a mile above its junction with the Jordan River.

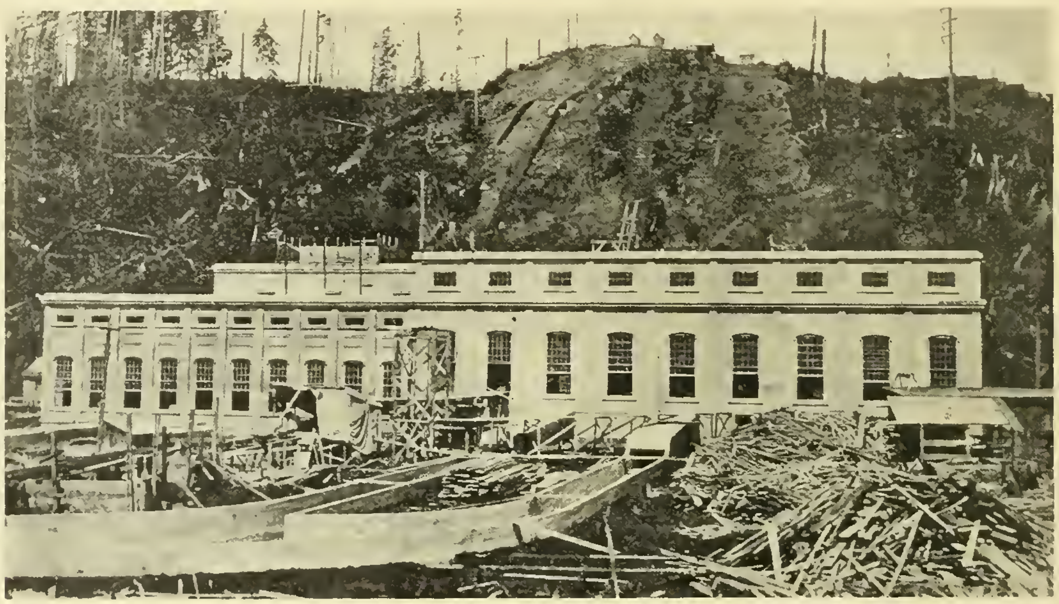
Transportation

One of the most serious problems connected with a development of this kind is that of designing and organizing an efficient transportation system. The distances are comparatively great, many of the grades are heavy, and the country through which the roads must be run is rough and heavily timbered.

Victoria is the nearest shipping point to Jordan River, and as there is no railroad connection between the two places it has been necessary to transport all freight by water. This method of transportation presents many difficulties on account of the unprotected nature of the coast, the rough water often encountered, and the lack of any harbor at Jordan River. At the time the work was started there was a government built road to within nine miles of the power house site. Although this road has since been extended to Jordan River, it does not offer a practical means of transportating large quantities of heavy freight and has only been used to a limited degree for passenger travel and emergency transportation. The transmission line material was distributed by means of this road.

All freight has been transported from Victoria on 60-ton scows towed by a powerful and seaworthy tug owned by the company. The water at Jordan River is too shallow to allow the tug to bring the scow to the wharf, so the tow lines are run ashore and the scow is pulled alongside the wharf by hand and there unloaded by a steam derrick.

At the wharf the freight is loaded on to double truck 3-ft. gauge cars, which are hauled by horses about a quarter of a mile to the foot of an inclined cable tramway. Here the cars are made fast to a ¾-inch plow steel cable and hauled up to the forebay reservoir, a distance of approximately 9,500 feet. The total rise in this distance is 1,125 feet and the maximum grade is 48 per cent. The cable is operated by a steam winding engine with 12-inch by 12-inch cylinders and the drum has a capacity of 10,500 feet of ¾-inch line. On account of several comparatively level portions along the road, the empty car will not overhaul with the heavy cable dragging behind, so another winding engine is placed at the lower end of the line and hauls the car back by a ½-inch cable. This lower engine is driven by a variable speed induction motor of 50 h.p. The haulage lines are supported on sheaves or rollers placed between the rails, and there is very little wear on the rope. This tramway parallels the pressure pipe lines, so that it has not been necessary to build other tracks or roads for laying the pipes. Loads of five tons and under are hauled on a single line, but heavier loads are blocked over the steepest grade. It requires about thirty-five minutes to make the round trip and as many as eighteen trips have been made in a ten-hour day.



Power house, showing completed building and tail race.

At the end of the tramway a small hand operated stiff-leg derrick is located, by means of this the loads are transferred to single or double truck cars to be hauled over the flume railroad.

The flume railroad parallels the flume for its entire length of 5.3 miles and is on a grade about fifteen feet above that of the flume. This road is also three-foot gauge and is built of 20-pound rails, as are all the other roads on the transportation system. The writer believes this to be about the "crookedest" piece of railroad in the world, there being practically no tangent and many of the curves being as sharp as 90 degrees. There are many short bridges and trestles along the line where it crosses small creeks, and it is built for almost its entire length along the steep hillside. The cars are drawn by horses or by a small saddle tank locomotive. The locomotive has been made into an oil burner to guard against fire.

During a part of each winter the flume railroad is put out of commission by the deep snow. This has made the transportation to the upper camps very difficult. During this time it is practically impossible to haul any heavy freight, but camp provisions have been carried on horse-drawn sleighs along the railroad tracks.

From the end of the flume railroad at the main diversion

dam a wagon road continues for about 4.5 miles to the Bear Creek dam site.

Bear Creek Dam

The Bear Creek Dam is built at a point about a mile above the junction of Bear Creek and Jordan River. The water is backed up the narrow valley for about two miles above the dam and forms a lake which at high water level, with the water surface five feet below the dam crest, has an area of 285 acres and provides storage for about 328,000,000 cubic feet of water. The drainage area above the dam is 8 square miles in extent and rises to an elevation of over 2,000 feet above sea level.

The dam is an earth embankment built by the hydraulic process. The greatest height above the bottom of the valley is 57 feet and the length on the whole is 1,020 feet. The crest has a width of fifteen feet, the downstream slope is 2½ to 1 and the upstream slope is 3 to 1. The spillway is excavated from the solid bedrock at the north end of the dam. The volume of the dam, as measured in the embankment, is 148,000 cubic yards.

In order to assure watertightness and provide a secure foundation, not only for the initial structure 57 ft. high, but for an ultimate structure 87 ft. high for developing the reservoir to its ultimate capacity, it was decided to drive steel

Bear Creek storage dam.

sheet-piling to bedrock, thus forming a curtain wall across the valley.

Interlocking 12-inch 40-lb. Carnegie steel sheet piling was driven in the bottom of the trench to bedrock by two pile drivers with 2,000 lb. drop hammers. The piling was furnished in lengths of 50 ft. and less. The driving was hard on the north end of the dam, but all piles were driven until bedrock was reached, as indicated by the testholes. The piles were cut off at a height of from 4 to 6 feet above the bottom of the trench and the trench was thoroughly cleaned out before sluicing was started. The total yardage excavated from the trench was 8,700 cubic yards. This material was piled about 15 ft. from the downstream edge of the trench and is included in the dam just below the puddle core. A total of 28,500 feet of sheet piling was driven to form the curtain.

The filling of the dam was started in September, 1911, Owing to the necessity of completing the work in time to store water for the 1912 dry season, it was considered advisable to provide a steam pumping plant to preclude, as far as possible, interruptions in sluicing due to the failure of the gravity supply. A steam pumping plant was therefore installed. This consisted of two 6-in. belt-driven centrifugal pumps having a capacity of 1,000 gals. per minute each, against a head of 250 feet. The boiler plant consisted of three 50 h.p. boilers using wood as fuel.

The quantity of water used in sluicing varied from 3 to 5 cubic feet per second and was discharged through 3-in. or 4-in. nozzles. It was not attempted to break up the ground, which was largely hardpan, with the jets, but powder was used throughout the job, the holes being gophered for 10 to 16 feet into the base of the bank along the surface of the bedrock. This use of powder broke the ground nicely and made it easy for the monitors.

Of the total volume of the dam 134,405 cubic yards of material was placed by sluicing. This work was done in 3,718 hours of actual sluicing, or an average of 870 cubic yards placed per 24 hours. The average quantity of water used was 4.5 cubic feet per second, and the average proportion of solids to the water used was 6.3 per cent.

The construction of the dam was started in November, 1910, and the work was completed in April, 1912. Since that time the dam has been in service and its behavior has been entirely satisfactory. Measuring weirs were built at several points below the dam to record the leakage, which was found to be so slight as to be almost negligible.

Shortly after the completion of the dam, and before the fill had drained out, the weirs showed 0.19 cubic feet per second, but this has since decreased to less than 0.1 cubic feet per second. There has been no appreciable settlement of the fill.

The undertaking to raise the height of this dam to 75 feet should be comparatively simple, as a safe foundation is provided and most of the perplexing and expensive features of the construction are solved. An extra 20 feet in height will nearly double the capacity of the reservoir.

The Jordan River Dam

Immediately below the junction of Wye Creek and Jordan River the canyon narrows and is crossed by a ridge of bedrock which extends well up on both sides of the canyon and across a fall on the east side of the river. This site was recognized as the best for a concrete or masonry dam of a permanent character. It was originally intended to place the diversion dam at this point, but owing to the limited time, the lack of a ready supply of concrete material near the site, and also in view of the probability of using the site at some future time for the construction of a high dam which would, in addition to diverting the stream into the flume, form a large reservoir, another location was chosen for the temporary diversion dam about 2,000 feet further up stream. In order to utilize the runoff from Wye Creek, a small diversion dam was also built on this creek and a branch flume was built to carry the water from this dam to the main flume on the east bank of the river.

The temporary Jordan River diversion dam was a substantially built rock-filled log crib sheeted with two thicknesses of 2-inch planks. It was founded on bedrock and the bottom edge of the upstream sheeting was set in a concrete sill. The length of the crest was 128 feet and the width 8 feet. Both faces were built on 1 to 1 slopes and the maximum height was 18 feet above bedrock. The flume intake was located at the east end of the dam and was also constructed as a rock-filled crib and line with two layers of 2-inch plank. The regulation of the flow of water was controlled by three timber headgates operated by rack and pinion. These gates discharged directly into an intake basin depressed two feet below the floor of the flume and provided with sand gates through which the silt and sand which might collect in the basin could be discharged.

The Wye Creek dam was of similar construction, but the crest length was only 90 feet.

These two temporary dams were completed during the summer of 1911 and gave satisfactory service until they were replaced by a permanent structure built on the site which had originally been chosen for the diverting dam.

The storage provided by the Bear Creek reservoir was

sufficient to supply the demands of the original power plant, but on account of the rapidly increasing demand for power is became necessary to increase the power house capacity and also provide greater storage. The increase of storage capacity could have been provided by developing any one of several reservoir sites, or by raising the Bear Creek dam, but the development of a rservoir at the diversion point offered advantages over any of the other propositions and the decision was made in favor of this site.

The choice of the type of dam for impounding the reservoir lay between a gravity type concrete or masonry dam and a hollow reinforced concrete dam of the Ambursen type. Test pits were sunk along the proposed centre line of the dam and bedrock was struck at depths varying from nothing to 18 feet below the surface, the average depth being 8 feet. This foundation was suitable to either type. The quantity of material required for building the structure, however, was much in favor of the hollow type dam. Time was also an important consideration, for it was very desirous of storing a good part of the 1913 spring runoff. Under these conditions the hollow dam was considered most suitable, and in August, 1912, the construction of this dam was started.

The reservoir is formed in the narrow Jordan River valley, but the water is also backed up into the Bear Creek and Wye Creek valleys, thus forming a lake slightly over three miles in length and having an area of 398 acres at the spillway level. The capacity of the reservoir above the outlet gates is 612,000,000 cubic feet.

At the dam site the sides of the valley slope up rapidly from the river, but at a height of about 70 feet the east bank flattens out and the slope is gradual back to the base of the hill. The crest of the dam is 891 feet in length, of which 130 feet is earth embankment with a concrete core-wall. The spillway is located near the east end of the dam. It is 305 feet in length and the crest is 8 ft. below the top of the dam, providing for a flood discharge of 23,000 cubic feet per second. The curved crest and rollway apron discharge the water clear of the toe of the dam and into a natural channel across the flat. This channel joins the river about 200 ft. below the dam. The extreme height of the dam is 126 ft. from the deepest part of the buttress foundations in the river bed to the crest. This is believed to be the highest dam in Canada, and it is the next highest Ambursen type dam built at this time.

In preparing for the foundation the whole area to be occupied by the base of the dam was not stripped to bedrock, but only those portions to be occupied by the buttresses and the cut-off trench. Trenches were excavated along these lines and all loose rock was removed and the bedrock carefully cleaned before placing any concrete. Wherever necessary the surface of the bedrock was roughened by blasting, or a shallow trench was excavated in the rock to provide a good bond for the concrete and guard against possible slipping. The cut-off trench, which was excavated along the upstream toe of the dam, varies in depth from 3 to 12 feet, depending upon the condition of the rock. In all cases it was carried to a sufficient depth to assure watertightness.

The dam consists of a reinforced concrete face or deck inclined at an angle of 45 degrees and supported on concrete buttresses which are spaced 18 feet centre to centre across the whole length of the dam. These buttresses are 12 inches thick at the top and increase, by steps or lifts 12 feet high, to 42 inches in thickness at the bottom of the highest buttress. The upstream edge is built on a slope of 1 to 1; the downstream edge has a batter of 1 to 4 to a point 18 feet below the crest, from which point it is vertical to the crest. Just back of the upstream edge a heavy reinforced haunch or shoulder is built on either side of the buttress and the decks are supported on these haunches. The buttress projects beyond the haunches a distance equal to the thickness of the deck. A bonding groove or key is cast in this projection. No vertical reinforcement is used in the buttresses excepting along the downstream edge and in the haunches, which are heavily reinforced to carry the decks. Horizontal reinforcement is used along the top and bottom of each of the 12-foot lifts or steps. Horizontal columns, or tie beams, which are reinforced top and bottom, connect the buttresses at various elevations and give them lateral support. The reinforcement in these beams is continuous through each three consecutive buttresses but is not carried continuously through the dam on account of possible strains set up by expansion and contraction.

Only two sizes of reinforcing steel were used in the entire dam, these being ⅞ in. and ⅝ in. square corrugated bars. Seven-eighth inch bars were specified for all of the main reinforcement. The ⅝ in. bars were used only for hooks and vertical reinforcement. The total weight of steel used in the dam was 380 tons.

Practically all the material in the dam was handled by a cableway spanning the valley on the centre lines of the dam. The length of the span was 920 feet. The standing line was 2¼ in. in diameter. On this a heavily built carriage was operated by a 2-spool cable engine. In placing the concrete the cableway brought the bucket over hopper-bottom cars which were pushed by hand along tracks laid on top of the buttress forms. These tracks were made up in sections about 12 ft. long, with platforms 3 ft. wide on each side of the rails. The space between the rails was not floored over so that the car could be emptied into the buttress form as it was pushed along the track. The car body was mounted on the trucks as a turntable and the spout could be turned in any direction. The track sections were secured to the buttress forms by means of chains with turnbuckles. The concrete was dumped from the bucket into the car and was then distributed in the buttress form or through chutes into the deck forms. Men worked in the forms and the concrete was carefully puddled as it was dumped. Shovels were used for puddling and no tamping was done. Forms, scaffolds and reinforcing steel were also placed by means of the cableway.

Jordan River dam, showing details of deck construction.

The construction work was carried on right through the winter, all work being confined to those parts of the dam on both sides of the river above high water level. This was only done under great disadvantage, as the winter was particularly severe, there being a depth of over 6 ft. of snow on the level at one time, and the ground was well covered until well on in May. The cost of clearing away the snow was a considerable item, and much time was lost.

(Concluded in Feb. 1st issue)

Electric Railways

London and Port Stanley Electrification Well Advanced—Orders Placed for 1500 Volt Locomotives and Passenger Cars

The energy will be supplied from two sub-stations: One located at London in an extension of the present Hydro-electric sub-station, and the other at a distance of 14.2 miles from London near St. Thomas. The latter will be a new sub-station. Each will be equipped with synchronous converters with their respective transformers and switchboards, converting from 110,000 volts, 25-cycle alternating current to 1,500 volts direct current.

The overhead structure will be of the familiar single catenary type supported on side brackets from lattice steel poles placed approximately 180 ft. apart on the tangent. The 0000 B&S copper trolley wire will be supplemented by suitable copper feeders.

The rolling stock covered by the initial order placed with the General Electric Company includes three 1,500-volt, 60-ton locomotives, five 4-motor 1,500-volt passenger car equipments complete with multiple unit control and air brakes, and four trail car control and air brake equipments.

The locomotives are of Type 4-0-4 and will be carried on two swivel trucks bringing all the weight on the drivers, the equipment being housed in a steel box type cab extending over practically the entire length of the locomotive. Each will be provided with four GE-251, 750/1500-volt motors designed for 750 volts across each armature and insulated for 1500 volts. Two motors will be connected permanently in series and the two-motor groups thus formed will be capable of connection in series or parallel for speed control.

The cab will be divided into three compartments, one at each end for accommodating the operator and the intervening compartment where the control equipment and accessories will be located. The operating compartments will be provided with 1500-volt electric heaters.

Each of the GE-251 motors will have an hourly rating of 245 h.p. with 1,500 volts on the trolley. At this rating the locomotives will exert a tractive effort of 21,500 pounds.

Control will be effected by a double end Type M standard equipment, a master controller at each operating position actuating the main 1500-volt contractors by means of a 600-volt circuit supplied from a dynamotor. Multiple-unit train operation is arranged for so that the simultaneous control of three locomotives coupled together can be accomplished from any master controller. The equipment is also so designed that a locomotive may haul a train of eight or ten passenger trail cars and provide lighting energy for them.

The current collectors will consist of pantograph slider trolleys having two contact pans pressing against the trolley conductor. Two of these devices will be furnished on each locomotive. They will be electro-pneumatically controlled from any operating position with one, two or three locomotives hauling a train.

Each motor passenger car will be driven by four GE-225-750/1500-volt fully ventilated commutating-pole motors connected two groups of two in series. The one-hour rating is 125 horse power with 1500 volts on the trolley.

Each motor car has sufficient capacity to haul one trail car and provision is made for the motor and trail cars to be operated in trains up to a total of three motor and three trail cars. All trail cars will be equipped with master controllers at each end so that multiple-unit train operation is possible from either end of any motor or trail car.

Control energy for a motor and trailer will be derived from a 1500/600-volt dynamotor on each motor car. The dynamotor will also supply energy for lighting one motor and one trail car. Main and auxiliary train cables will run continuously throughout a train, provision being made for the simultaneous raising and lowering of all pantographs and also for simultaneous sanding (by electro-pneumatic valves) of all cars from any operating position. The pantograph trolleys will be identical with those on the locomotives.

Each car will carry a combined straight and automatic air-brake outfit of the variable release type, with the air supply furnished by 1500-volt compressors. The compressor governors will all be equalized on a special wire running throughout the trains in the auxiliary train cable.

The cars will be all steel, 59 feet long and thoroughly modern in every respect. The motor and trail coaches will be identical except for motors. The former will weigh approximately 51 tons loaded and equipped, while the latter will have an approximate loaded weight of 32 tons.

'Safety First' Movement Results in Reduction in Fatalities by Almost Half

The success of the Safety First movement, inaugurated in Montreal by Mr. A. Gaboury, superintendent of the Tramways Company, is demonstrated by the great decrease of the number of actions in the local courts for damages against the company. This decrease is about 50 per cent., and measured by the amount claimed the falling off is considerably higher. The number of accidents, either due to the fault of the public or to that of the employees of the company, has steadily decreased since the movement was started. At the beginning of the campaign the effect was comparatively small, but as the officials continued their educative work the accidents became less and less; in other words, the cumulative efforts began to bear fruit. This is seen in the records of the coroner's court, the deaths due to tramway accidents last year being only 20 as compared with 34 in 1913. The accidents were mainly due, according to the verdicts, to the imprudence of the victims. The Tramways Company are continuing the work, having distributed 500,000 blotters, printed with a number of useful "Don'ts," and also many large illustrated calendars showing how accidents are caused. The city are co-operating, and the Chief of Police has distributed some 24,832 circulars, one being addressed to every holder of a vehicle license in the city. In this letter, the Chief impresses upon the recipients the importance of strictly observing the traffic regulations which are quoted in the circular. A diagram showing the right and the wrong way to operate a

vehicle at a street intersection, and when proceeding from one street into another, is appended to the circular with full explanations in both languages. A copy of this circular is posted in every police station.

City of Toronto Places Order

Works Commissioner Harris, of the city of Toronto, has placed an order with the Preston Car & Coach Company for three double-end, single truck, pay-as-you-enter cars, mounted on Brill 21-E trucks, 8 ft. wheel base, cast iron wheels. The electrical equipment will be G. E.-80 with K-10 control. Car bodies will be 21 ft. long with clear space inside of sheathing in each vestibule of 6 ft. The cars are to be especially wide for single truck cars, being 8 ft. 5 in. over side sheathing. The vestibules are to be extra wide, being 8 ft. wide. The outside of cars will be painted Pullman color; interior will be finished with golden oak; the seats will be of the walk-over style cross seats, upholstered in woven rattan, spring upholstered cushions and backs. The coilings will be painted agasote. There will be six automatic ventilators in the ceiling of each car. The heaters will be Cooper hot air heaters; fenders will be Watson automatic. Sano hand straps will be fastened to the ceiling over each short longitudinal seat at each end of car. There will be no bulkhead in either end; suitable pay-as-you-enter railings will be installed. The seating capacity will be thirty-two; total weight of each car will be approximately 25,000 lbs.

Toronto Municipal Extensions

On January 1st the ratepayers passed both the civic by-laws authorizing expenditures for municipal railway extensions. One of these is for an extension to the present St. Clair West line on Lansdowne Avenue south, to cost some $105,000. The other by-law authorizes a municipal electric line north and south through Mount Pleasant Cemetery and through Moore Park. Towards the southern boundary of Moore Park the proposed line turns west across the Rosedale Ravine close to the present C. P. R. bridge and continues along Shaftsbury Avenue to Yonge Street. The cost of constructing this road is estimated in the neighborhood of $325,000, including equipment.

Must Pay Share of Cost

The Dominion Railway Board have issued a statement through chief commissioner Scott, supporting a recent decision of their own, under which a share of the cost of the North Toronto grade separation on Yonge Street, as well as Avenue Road, must be borne by the Toronto Railway Company. The inclusion of the Toronto Railway Company, according to the statement, is in harmony with the established policy of the Board as laid down in 1909.

A Good Man Passes

Electrical men all over Canada will be shocked to learn of the recent death, on December 24, of Mr. H. Howard Stannard, for the past nine years associated with Mr. G. M. Gest. Mr. Stannard was known in nearly every city and town in Canada, and was always welcomed wherever he was known, not only for his genial disposition, but because it was recognized that his work, that of improving our electric systems and replacing unsafe and unsightly wooden poles with the modern and efficient underground cable, resulted in his leaving a town in a more advanced stage of civilization and prosperity than it was when he entered it. Mr. Stannard's efficient work throughout Canada will long remain a monument to his ability, as will our kindly recollections of him, to his sociability.

Electrical Developments in 1914

(Concluded from page 22)

range which, both in price and efficiency, will meet the great demand of the majority of housekeepers. Present indications are that the range of the near future will be more nearly comparable in price with the coal and gas range and will compare with the latter entirely favorably from the operation point of view. As noted above, the Canadian manufacturer is demonstrating his ability to hold his own with the competition of the United States and British firms. One manufacturer writes: "We are very much encouraged and the reports which come to us from a large number of the dealers throughout Canada, complimenting us on the attractiveness of our goods and the way they stand up, is very gratifying to us as Canadian manufacturers."

Another company manufacturing glassware only advise us that during the year 1914, they increased all their lines materially and have under way at the present time quite a number of new designs of fixture glassware including semi-indirect bowls and the different styles of globes for nitrogen lamps.

During the latter part of 1914 one of the specialties of the electrical industry which has become popular is the interchangeable letter shop window sign. A number of these devices which flash their message in bright letters, right at you from the window itself, have been placed on the market. The special construction for readily changing the reading matter, neatness of appearance and comparatively low cost have already placed the signs in great demand and this device has had a ready sale which indicates that the merchant is alive to any efficient method of securing the attention of those passing by his shop, whether they be on the near or far side of the street, or whether they pass in day or night time. These signs are the result of an evolution in electrical devices that give messages from a shop window and have relegated to the obsolete, the old glass letters with series filament and the single unit letter requiring an incandescent lamp for each letter. The two former have pioneered the way but are now comparatively very expensive, since the newer signs at lower cost and upkeep and with unlimited variation in messages is now within reach of the pocket book of every retail merchant who is fast realizing that an effective anouncement from his window is of just as much value as in a daily newspaper.

Effect of Lower Rates

In this connection no review would be complete without a mention of the considerable reduction in rates that has just taken place throughout the area served by the Hydro-electric Power Commission of Ontario with Niagara power. It is true that the Commission's rates are not specially calculated to benefit very small consumers. From the point of view of the current supply company, however, this is not a matter of extreme importance. A very small consumer is not in a position generally to purchase electrical equipment with which to consume more current. On the other hand, the householder will be only .9 cents per kw.h. At this rate benefit from the reduction in rates is also in most cases able and willing to purchase all the little electrical appliances which go to make housekeeping today very simple and health-conserving, as compared with what it was before the advent of electricity. In many of the towns throughout the hydro zone, the ultimate cost of the current consumption of the householder will be only 9 cents per kw.h. At this rate there should be much less difficulty in placing electrical equipment very generally throughout the homes of south-western Ontario. Of the municipalities mentioned in the recent publication of rates, the ultimate cost is in no case greater than 1¾ cents.

The Dealer and Contractor

Typical House Wiring Plans

In a recent issue of the Electrical News we described with detailed plan and specifications, the typical wiring installation for a house of moderate size and cost. So far as we know, it was the first attempt, certainly in Canada, to cover the field of electric house wiring in a thoroughly systematic manner. It is gratifying to know that the article gained wide publicity and we are well repaid in the belief that electrical contractors all through the Dominion have derived a certain amount of benefit in their work from this article. Of course there were comparatively few cases where the specifications could be adopted absolutely as they were published, but we have been given to understand that the suggestions contained in this article have been conducive towards opening up a big field of enquiry. We hope the field will widen and that enquiries will continue to be made until the standard of electrical contracting has been raised very much above where it is at the present time.

Hoping to give this important matter still more prominence we reproduce in the present issue a sketch of the layout of the wiring plan for another type of moderate-sized residence. Possibly this plan of residence will appeal to a number of householders who were not pleased with the original plan. In any case the suggestions contained therein, being essentially different from those contained in the original article will open the way for discussions. We believe much good could result from a spirited discussion among the contractors on such topics as this and we would welcome any letters for publication. In the absence of anythng in the nature of an electrical contractor's association, such a medium as the Electrical News which reaches all the more reliable dealers and contractors of the Dominion, is the only channel through which the ideas of the readers could be made known and exchanged. In this connection we ask the attention of other Canadian electrical contractors to a communication on another page from Mr. Geo. J. Beattie, Secretary of the Toronto Electrical Contractors' Association, on a topic of vital importance to the electrical contracting profession.

Regular form for estimating

The article in question, in addition to outlining the system most suited to this particular residence, urges the contractors to use some definite method in preparing their estimates. It advises them to use a printed form which may be purchased in different places or which may be the result of a contractor's own individual experience. Many contractors find the latter the most satisfactory way to prepare his contract forms, but for the beginner, or for any contractor who has not, up to the present time, any systematic method of preparing his estimates, the printed standard forms would probably be most suitable, at least in the meantime.

The article also impresses the value of keeping records of work done, as these are useful in assisting the contractor in his future estimates. For example, he may, in the course of his year's work, have to estimate on two or more houses of practically the same dimensions and the same plan; or he may meet an obstacle of a certain kind in two or more houses in the same year, such as a very thick stone wall or one of the many obstacles frequently met by contractions. A contractor, known to the writer, very often allows for unseen contingencies in his estimate, especially where the chances are that more difficulties will be met with than are visible on the surface; the estimate is therefore submitted provisionally, the provision being that if the obstacles met are greater or less than anticipated, the total cost of the work will, in proportion, be greater or less than the submitted price. In the case of an absolutely conscientious contractor this is no doubt a very satisfactory system to follow, but it would be necessary for the contractor to have the confidence of the householder whose work he is doing.

Use plenty of copper

The article further emphasizes the value of plenty of capacity in the lead wires. This is a very wise precaution. Even with our present knowledge and appreciation of the value of electrically heated appliances, few of us have yet realized the extent to which these appliances may, and likely will be, used ten years from now. In the installation of wires in a new residence it cannot be considered satisfactory, therefore, unless it provides for ample illumination, for cooking, and at least localized heating. The advent of the smaller size projection lantern and moving picture machines is also to be reckoned with as these consume a considerable amount of current. Strictly speaking no room in the modern household should be without one circuit available of sufficient capacity to carry from ten to fifteen amperes.

It is not our intention to criticize this article, but we would point out that the article previously published reproduced pretty closely our ideal of a properly wired residence. We many mention however that the value of $169 for a house containing only forty-six outlets is something quite beyond the dream of the Canadian electrical contractor, at least in the very near future. There does not seem to be anything in this installation which justifies this figure. It is true the knob-and-tube work is replaced in the specifications by flexible cable, but the difference in cost is not apparent. The Canadian contractor would probably be willing to take off a third and likely would be forced to divide this price in two if he expects to land this job. However, these are conditions which electrical contractors have to contend as a result partly of lack of co-operation and partly of conditions over which nobody, as yet, seems to have any control.

Cedars Plant Operating

The high tension transmission line of the Cedars Rapids Manufacturing and Power Company, connecting the Cedars Rapids plant with the city of Montreal, and which was built by the Montreal Light, Heat and Power Company, is now in operation. This is a 44,000 volt, steel reinforced, aluminum cable supplied by the Northern Aluminum Company. This line is approximately 30 miles long.

Eliminate the Quack Contractor

The difference between good and bad workmanship in every line of business can only be judged by the evil effects.

A quack physician who takes charge of a case of measles in a country home cannot cause as much trouble by his inefficiency as if he tackled a case of smallpox in a crowded city.

So, the crime of the quack electrical contractor is big or little according as his operations are on a large or small scale, in a sparsely settled or congested district.

Fortunately the quacks stand little chance of getting any very big jobs, but they cause lots of "local" trouble just the same.

So far as the troubles resulting from quacks can be localized the public are inclined to let a man do pretty much as he pleases. They don't sympathize with him when he gets "his" however.

Whether the penurious individual who gets sick chooses to employ a quack or just dies in peace is no concern of the general public so long as his stupidity does not affect his neighbours.

If any isolated householder prefers to have a quack install his wiring and as a result has a fire or a fatality in his own immediate family that may seem to be his own business.

But, if the penurious individual dies of smallpox and succeeds in spreading it through his neighbourhood, the case is different.

And if the fire caused by the incompetent wiring burns down a whole block where the wiring, with the exception of that one little corner, may have been entirely modern, it surely is a case for government action.

Here we seem to have an unanswerable argument against the operation of the quack contractor in congested localities.

A single corner containing poor work nullifies all the caution of the remainder of that district.

Plainly if we tolerate one single quack electrician we may as well have all of the same breed.

Then—let's **eliminate that single quack.**

The Hydro-Electric Power Commission of Ontario are now working to that end. At the present time they are busy perfecting rules and regulations, but what use are they unless enforced?

About as much use as an order to isolate whooping cough in a "dago" city ward.

The Commission, or better still, the Government must **enforce** this rule.

This means eliminating **incompetents.**

It also means efficient Inspection.

It also means a lot of other details which must yet be worked out before electrical contracting becomes a profession.

Now, again, it is typical of governments that they only act under pressure—that is, they rarely legislate before there is a demand for legislation.

The two elements who are interested in electrical contracting conditions are (1) the public and (2) the contractors.

And the public does not know a single thing about it. "What the eye has never seen, the heart does not covet."

Then it is "up to" the contractor.

Will the contractors of Ontario, and the dealers, and the jobbers, all of whom are indirectly interested, not **get together** and show the government that there is a **demand** for redress against these evils. While the Commission is inclined that way is the time to speak out. Now, before he gets a chance to cause any more devastation, let us put our heads together, our shoulders to the wheel, and roll the quack electrical contractor out of existence.

Read Geo. J. Beattie's letter, and K. G. MacDonald's article.

The West's Greatest Need—Co-operation

By K. G. MacDonald*

Should you ask me what is it that the electrical trade in Western Canada needs most to-day, I would unhesitatingly answer,—CO-OPERATION. Should you ask me what it lacks most, I would give you the same reply,—CO-OPERATION.

It is not at all a pessimistic attitude I take when I say this, but rather one of optimism. For there is comfort to be found in the knowledge that the caliber of the men engaged in the electrical trade in the West, is such as to make for a better, bigger and broader sphere for their activities, once these activities are directed along the all-conquering lines of CO-OPERATION.

We may well give our time and thought to this question, of how the day can be hastened when we will find in the electrical trade that spirit of unselfish effort, of the placing of the best interests of the trade above the matter of purely immediate, selfish personal gain. I say immediate, because any profit derived through selfish means is not the kind that repeats, and it does not redound to the lasting benefit of the individual much less the trade as a whole.

We find this spirit of CO-OPERATION in almost all other lines of business. The same factors are to be found in our lines as are found in others. Generally speaking the personnel of the electrical trade is identical with that of any other line. We are all in business for the same purpose, namely, net profit. Why, then, should we not adapt ourselves to methods of business that have been proven beyond the possibility of contradiction to be in the best interests of all concerned?

In order that this much to be desired state of affairs may become a reality, we must, first of all, have UNITY. Unity of purpose and unity of action. There must be that knowledge grounded in the minds of each and every man in the business that the other fellow is working along lines which are unquestionably fair and above-board. On the part of the contractor there must be no more of that idea, which says, "I might as well cut my figures away down, for So-and-so will be sure to, anyway." On the part of the Jobber there must be no more of that all-too-prevalent idea, that, "We might as well sell this fellow, for if we don't, So-and-so will, and why should we lose the business?" In order that these attitudes may be dropped, we must have UNITY.

Then again we must have DETERMINATION. No reform that amounted to anything was ever carried through without a fight, and ours will be no exception. However, the stiffer the fight, the more decisive and more far-reaching will be the victory. There will be kickers of course, lots of them. Their objections must be overcome; they must, if

*Canadian British Engineering Company, Limited.

necessary, be educated. There will be those who will adopt a neutral attitude,—on the fence, waiting and ready to drop off on either side as the tide of victory turns decisively in one direction. These must be shown that the only profit worth having is that earned by conscientious effort. All this calls for determination. Determination born of the knowledge that the fight is for the betterment of the trade and the up-lift of business generally.

In order that this spirit of Unity and Determination may be generated, at least two things must be realized. The Contractor and Jobber alike must realize that the placing of the trade on a firmer basis is not going to detract one iota from the volume of work to be done. And the Jobber must also realize that, with this desired condition a reality, he can reduce the cost of doing business from two to five per cent. For, with all customers getting a fair and just price for their work and material, and all undesirables weeded out or placed on a strictly cash basis, their cost of handling collections is thereby reduced and their risk in bad and doubtful debts is at a minimum.

The need of reform in this direction is apparent. The advantages to be derived from it are equally apparent, and may the time soon come when the electrical trade will take its place beside others which today stand for all that goes to make up sound, honorable and dignified business. And may each and every one of us be willing to do his share in the bringing about of this condition so that we can all look back with pleasure and say, "I helped to make the electrical trade in Western Canada what it is today, and mine is a just share of the profits."

Electrical Contractors of Quality

Editor, Electrical News:

"Electrical Contractors of Quality" is the very apt heading appearing in the Dealer and Contractor Section of the January 1st Electrical News.

The statement made that "The electrical contracting field seems to be more susceptible to the operation of 'incompetents' than any other business on the face of the earth," is undoubtedly true, but before prescribing a remedy we must first analyze the cause, and in this way, perhaps, a remedy can be suggested.

The engineer who is to take charge of a steam plant or even a portable boiler must first pass an examination and secure a license which certifies to his ability and capability to handle the plant of which he is to have charge; even the plumber, or, as he is now called, the sanitary engineer, must, before he is allowed to engage in the work, secure a license, and then, before proceeding with the work, he must file a plan of what he proposes to do, have it approved, —and then the work is inspected from time to time as it progresses and until it is finally completed.

It is in very few buildings that a steam plant is installed where it is necessary to have a licensed engineer; consequently the danger here is very much "localized," affecting only, at the very most, buildings immediately adjacent to the steam plant. The sanitary engineers' services are, of course, required in nearly every building, but a defect in the one building, even if serious, really only immediately endangers the health of the persons occupying that particular building.

Yet both of these branches of industry are protected by examinations and other safeguards, including inspection, and cannot be operated until they have been approved by the properly constituted authorities.

But of the electrical wiring equipment and its proper installation,— is it safeguarded?—Decidedly, No!

What the writer has to say in the following paragraphs is the result of actual experience and observation covering a period of the last ten years.

The electrical contractor today, at least in the Province of Ontario, has neither to pass an examination as to his qualifications nor has he to submit a plan, of any kind, of buildings to have them approved.

The owner of the building desiring to have some wiring done calls in an "electrical contractor" (?) and says, "I want a light here, a switch there, and so on," but does not have a plan and specifications prepared, or, in fact, any details of the work. The legitimate electrical contractor figures on the work as he knows it should be done, figures liberally on his copper and other materials and submits a right price. The, shall we call it, illegitimate contractor, also comes in, figures on the cheapest possible method of doing the work, skins everything to a fraction, and below, puts in a much lower tender—and secures the work.

Then again, the average architect's electrical specifications and plans are worse than a joke. The locations of the outlets are marked on the plan, if at all, in the most haphazard manner. The specifications drawn by the architect, if drawn at all, are of the most meagre character, and cannot be understood either by the contractor or the architect himself—and the various electrical contractors naturally interpret them as they please. Even with the best of intentions they have no other alternative. Generally, in consequence, the lowest price secures the work, regardless of the value rendered to the owner, and the architect who howls with a loud voice if any incompetents tread on his toes in his own business (which isn't electrical contracting), is the hardest man to convince that he should have decent reliable electrical contractors whose reputation amounts to a great deal more than the profit on the job.

This is the almost daily experience of every reliable electrical contractor in the business and works out as much to the disadvantage of the owner as it does to that of the electrical contractor. The writer knows today of many buildings in the city of Toronto where the owners have seen the "error of their ways" and have put in a good, safe electrical equipment. Next door to them you will find a penurious owner who has a wiring installation which is hazardous to his own and the surrounding buildings. If it were brought to his notice, he would probably say "that wiring has been in here for ten years and has not caused a fire, so why should I change it?" Next day he possibly has the fire.

The "here today and gone tomorrow" electrical contractor is the result of the absence of a licensing system which will not only keep track of the many contractors, but will penalize them if they do not do their work properly; and of the lack of a system which should require the filing of proper plans and specifications for electrical work and proper approval therefor before the work can be proceeded with; and suitable laws to prevent additions to existing installations without securing a permit. There are other causes, which can only be remedied by the cohesion of the legitimate electrical contractors.

The remedy for the major portion of these ills can easily be found and in justice to the public, if for no other reason, should be applied forthwith. We should have:

(1) a system which will first license the electrical contractor before he can do business at all. The license fee should be high enough to prevent anyone taking out a license for one job only, but not high enough to stifle competition or prevent those intending to do legitimate business from

starting in business. As the license would be more or less a guarantee on the part of the municipal or governmental authorities that the contractor was competent, a bond should be exacted so that if the contractor should be unable or unwilling to make his work comply with the standard adopted, the authorities could take over the work and charge it against the amount of the bond.

(2) Before doing any electrical work the architect or contractor should be required to file a plan and specifications of the work proposed to be done.

(3) Before work could be started this plan and specifications should be approved and a permit issued, and

(4) Work should be approved by a properly equipped inspector before connections can be made by the central station.

Of the minor details of enforcement of the law, a system could be developed which would protect all the parties concerned.

None of these reforms can be accomplished without united effort on the part of the electrical contractors themselves. Let them forget their petty differences and sit down and discuss all these difficulties like business men. Then only will they raise the electrical contracting business to the dignity of a real profession—giving the public a fair and square deal—and make a decent profitable business for themselves.

Yours very truly,

(Signed) George J. Beattie.

72 Victoria Street,
Toronto, Ont.

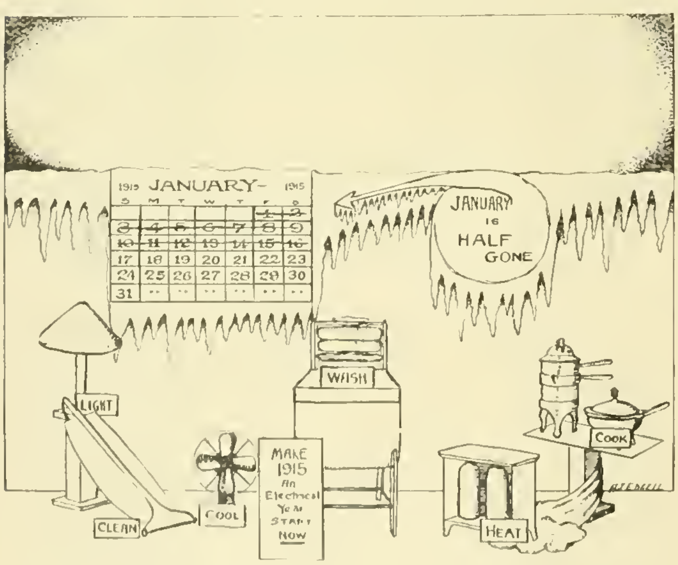
Make 1915 an Electrical Year—Start Now

By A. J. Edgell, Society for Electrical Development

January is considered a quiet business month and will be found so by the man who makes no special effort to stir things up. The average dealer lessens his endeavors to attract trade after Christmas and figures that he might just as well take things easy until the beginning of the busy season. The wise dealer doubles his efforts during this first month of the new year and, as a result, has a very good month's business and gets a flying start.

There is always business to be had by going after it and far-seeing merchants work harder and advertise more when business is inclined to lag. More than ever they pay especial attention to their displays using the utmost care in the selection of the articles to be shown, so that they will appeal to the biggest percentage of the passing public.

In many cases, the show window is the only advertising medium a dealer uses and he receives inadequate returns from it because he does not put the necessary effort into it. One way in which show window advertising differs from all



Suggestion for dealers' window design.

other kinds of advertising is, that there is no doubt as to the returns obtained. Effort put into a show window is sure to bring results in proportion to the endeavor made.

The dealer who has not given much attention to his displays will find that one of the best improvements he can make in his merchandising methods for the new year, is that of bringing his displays up to a higher standard. It is an improvement that will pay him well

Displays should be changed on an average of once each week, otherwise the pulling power is weakened. Frequent changes keep the public watchful and interested. The window that has some new feature each week is especially productive.

The accompanying sketch shows a window suggestion that is seasonable. A card-board circle with arrow pointing towards a large calendar has inscription "JANUARY IS HALF GONE." The calendar shows the month of January with half the days marked off. The calendar and circle with arrow may be obtained from a card writer. Icicles cut from card board or cotton batting complete the background setting. The various labor-saving and comfort-giving devices suitable for the home are shown. A large card reads:

MAKE
1915
AN
ELECTRICAL
YEAR
START NOW

Timely 1915 Calendar

The Stuart-Howland Company, Boston, Mass., are distributing a very timely 1915 calendar, the principal feature of which is a map of the war zone of Europe. It is safe to say that this map will find a prominent place on the wall of most electrical men. A quantity of interesting information is also given regarding different countries, their population, and their army and navy strength.

A Handsome Diary

The Siemens Company of Canada, Limited, are again distributing a very handsome little diary for 1915, of a size suitable for the vest pocket. In addition to the usual memoranda and diary pages, a quantity of useful and interesting information is included, which treats of the products of the various Siemens Companies.

Modern Wiring System for Small Residence

Model Layout With Valuable Suggestions on Methods of Estimating —Contractors Should Keep Records

We shall take as the basis of the present estimate, the use of steel armored conductor throughout the house, with rigid iron conduit in the basement. Regarding the latter, would say many contractors prefer, even where the job is flexible steel armor, to use the rigid conduit in the basement. Among the reasons are, it is probably little, if any, more expensive, the work is much better looking, is less liable to injury and more proof against the dampness and moisture which is quite frequently found in basements. Also, there is a tendency in many cities to require rigid conduit in the fire districts. For this reason, the present estimate contemplates rigid conduit in the basement, with steel armor throughout the balance of the house.

It is not required that the layout suggested should be followed literally and exactly, but instead, it is more a graphical representation of the dividing up of the house into circuits, together with some suggestions as to where these circuits might conveniently be run. The construction of the building is of paramount importance with respect to this feature. The direction in which the joists run, the character and style of the partitions, whether there are main partitions extending to the third floor from the basement, and features of this kind are the final and determining factors.

For the purpose of this article, the building is assumed to be of frame balloon type construction. That is to say, 2 x 4 studding with 1 inch sheathing boards on the outside, rather than plank. This means there is the same space on the outside of the building, in fact rather more, than is found in the interior partitions. It is frequently much easier therefore, to fish from the upper storeys to the basement in a building of this character on the outside walls, than it is within a partition.

The service wire has been made No. 8 not merely because of voltage conditions, but because many engineers and lighting companies feel this is the smallest wire which should be used for that purpose. The No. 10 sub-feeder wire, extending to the main distribution box in the centre of the basement is amply large for the load. It is always desirable to have the flush receptacles on a circuit by themselves, so that they may be fused to a point to properly care for the various devices and appliances. In the present instance, there being four of these receptacles in the first floor, a separate circuit has been provided for them. The fifth receptacle, however, in second floor bedroom, it was not thought sufficiently important to warrant extending this special circuit to second floor for that purpose.

Use Plenty of Capacity

Attention is called to the fact that the 3-4 inch feeder conduit in basement is sufficiently large to permit of installing a pair of No. 8 wires later on, should the use of additional current in the building require it.

All outlets are marked with the number of lights, these being ample for all normal conditions. Figures are intended to cover standard 40 watt mazda lamps. Receptacles are figured on a basis of 100 watts each.

A saving might be effected in placing together the two three-way switches on the first floor at entrance, rather than having one at the door and the other at foot of stairs. As the three-way switch, however, is essentially a convenience and a protection, it is best to locate them at the most convenient points. The receptacles have been located with an idea to their use for vacuum cleaning purposes, other things being equal. With respect to the parlor receptacle, the location of the piano has been taken into consideration in this same connection. The pilot lamp for basement is usually placed at a conspicuous point in kitchen and fitted with a red globe, so that the light will be plainly apparent whenever the basement light is on.

The cord drops are not included. It is ordinarily desirable to omit from the wiring system any articles which might properly be included with the lighting fixtures. A drop cord is essentially a fixture, and there seems no logical reason, therefore, for including it with the wiring. The four wires for dining room centre are required in connection with the electrolier switch which is of the two circuit type, since outlets in bath and rear bedroom, second floor, are supplied through the dining room outlet. It is believed careful examination of the sketches in connection with the estimate will show the reason for the other items.

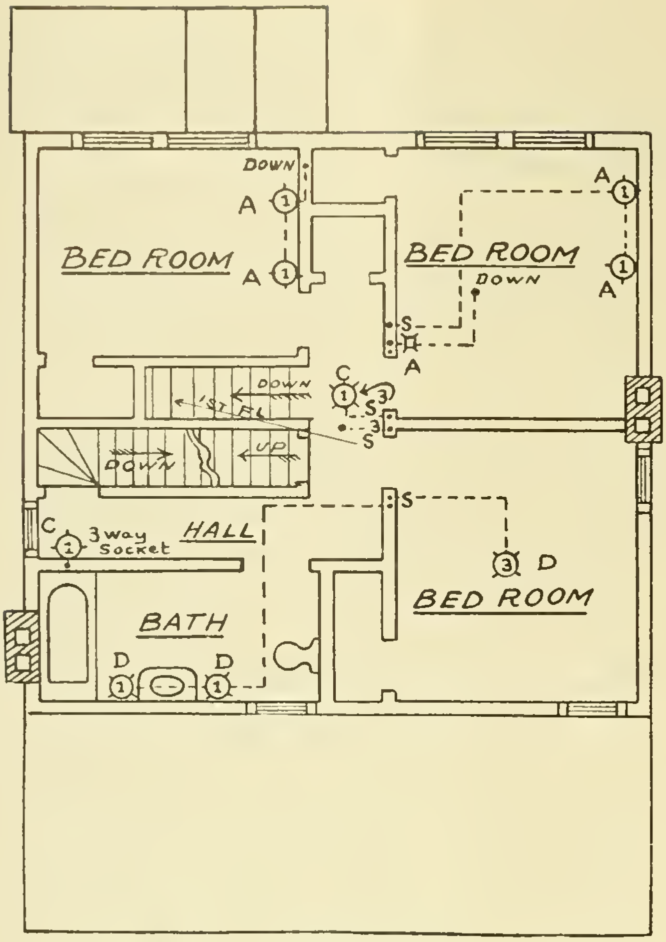
Estimate on Printed Form

In preparing the estimate, it is always best to follow a printed form, such as the Universal Estimate Sheet of the N. E. C. A. This assures that all necessary articles will be included, and they may be checked off. The first thing, therefore, is to fill out this blank, following a careful reading of the specifications. Put down the number of centre outlets, the number of side outlets, the number and kind of sur-base receptacles, the number and kind of switches, the style of work, together with the total number of lights. If these are not indicated on the plans, use your judgment and total them up, allowing not less than 80 watts, preferably 100 watts for each receptacle. Lastly, put down the name of the architect. You may have cause to remember him in making other estimates later on. The requirements and personality of one architect as compared with another, frequently represent the difference between a loss and a profit on two different jobs. Your records covering a period of years on matters of this kind are instructive and valuable. In addition to the value of being able to see at a glance what the installing of a number of outlets, receptacles, switches, etc., cost on one job as compared with other similar jobs, it is instructive in assisting you to eliminate the guess element in your labor, and enable you to arrive at a close approximate estimate on the cost of a given job, before you have actually figured it. In this way you can check your figures after the completion of the estimate. While it is true that this is a rough check, when the estimates of a period of years are taken, they approximate actual figures very closely and will many times be the means of saving you from a loss, due to a mistake in your estimate sheet. As a check, it is valuable.

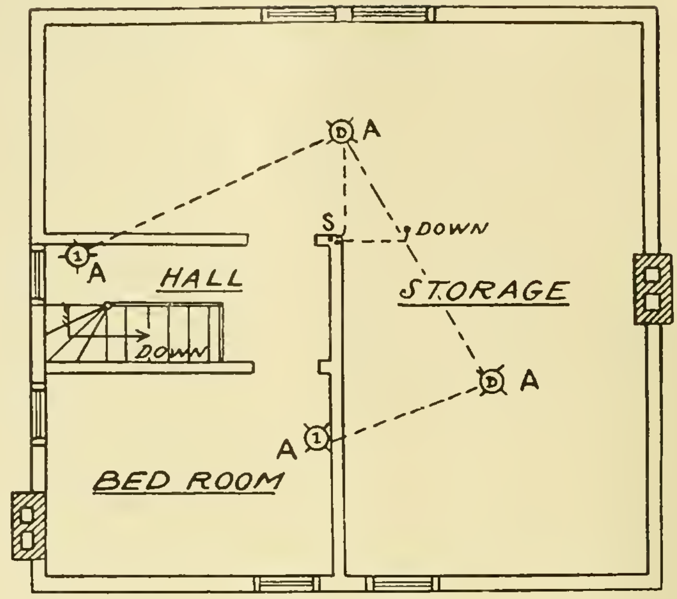
Having put down all the above items, you immediately have a lot of information to put on your estimate sheet.

Always go through the job in the same way. In other words, have a definite system and follow it. You thereby avoid mistakes and the overlooking of items. You will find your estimating simplified and that you will be able to do it more rapidly.

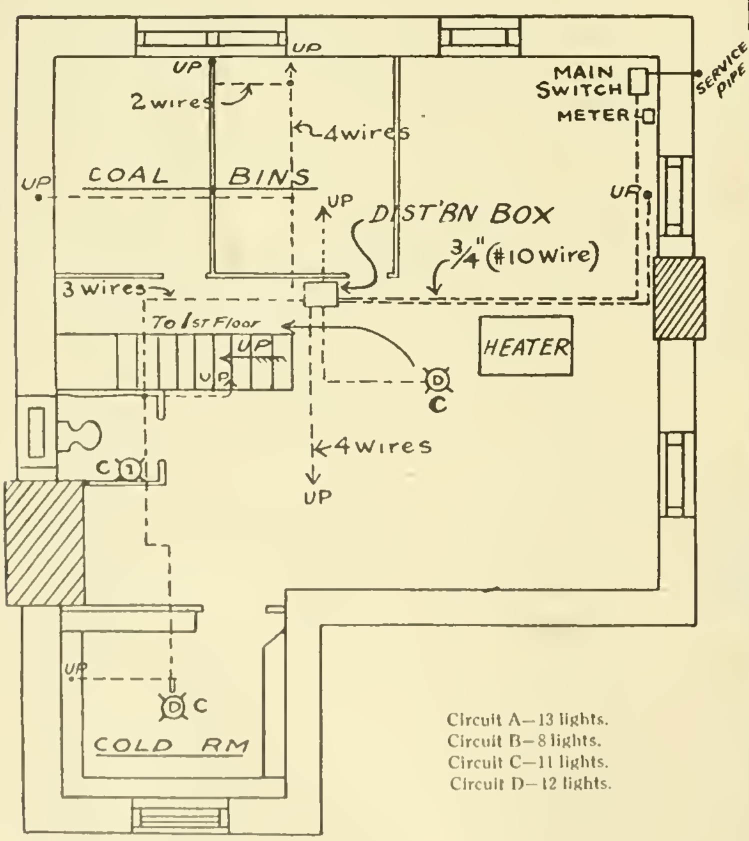
Let us take first the item of inspection fee which is charged in most localities. We then begin at the service, taking first the service conduit, then the service cap at the top end, the ell condulet at the basement ceiling, and finally the main iron box or cabinet containing the main switch. Following this, we go to the distribution box, and on the

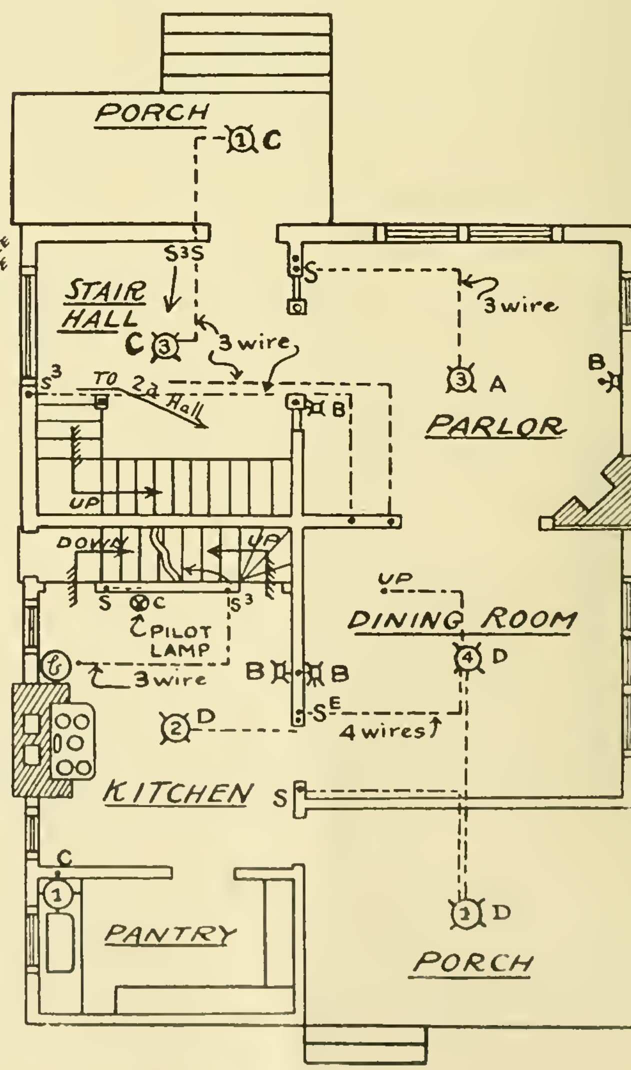


Second Floor 9'-0"



Third Floor 8'-6"





Circuit A—13 lights.
Circuit B—8 lights.
Circuit C—11 lights.
Circuit D—12 lights.

Basement 7' 6"

First Floor 9'-0"

way take off the condulet tap for meter, together with the B condulet at the meter, and likewise the meter board itself. The amount of service conduit immediately gives us the quantity of service wire. To this we add for the four or five feet of free ends at the top required by most lighting companies. From the meter, we extend the ¾ inch feeder conduit to the main distribution box in centre of basement. Having come to the box, we put down the fuse blocks and the fuse plugs, having ascertained from the number of lights just how many circuits will be required. The amount of ¾-inch conduit gives us the quantity of No. 10 feeder wire, allowing sufficient for connection at both ends and for the meter loop.

This completes the service, the meter loop, the subfeeder and the distribution box and we have therefore, come down to the branch wiring proper. Again turning to our schedule, we take off the number and kind of receptacles and switches. This in turn gives us the number of switch and receptacle boxes.

Arrange Circuits Carefully

Turning to our plans, we look them over carefully, laying out the circuits, not alone with respect to the minimum quantity of material, but the convenience of the system to the house owner as well. This means, among other things, that one circuit should not be loaded to capacity, and another one have only a small number of lights. While it may be within the Code Requirements, the owner may happen to add some little lamp or device to the already crowded circuit, with the result that the fuse will blow out. It usually happens in fact, that this is in the rooms that are most used, and is therefore, doubly annoying. The owner often concludes when this experience is repeated, that he has received a poor wiring job. As a matter of fact, he is correct. Other things being equal, it is also desirable that circuits be arranged so that on the rupture of a fuse, all of the principal rooms or all of a floor shall not go out at one time. Frequently this can be arranged without any additional cost in the wiring system.

If the building is small, it is a considerable assistance to make a layout of the circuits, roughly, either on the plans, or preferably on a piece of scratch paper.

Having laid out the circuits, we are prepared to take off the measurements. Set down on a piece of scratch paper, a series of columns, one marked for ½ in. conduit, one for ¾ in. conduit, and one each for all other conduit sizes. In the present instance, we put down two columns for ¾ in. conduit, one marked ¾—3, and the other ¾—4, so that when we take off the wire quantities, we will know the one conduit contains three wires and the other contains four wires. Also make a column for two conductor armored cable and one for three conductor cable.

Having done this, measure the wire, conduit, etc. After adding these items and multiplying the conduits by the number of wires in same, and getting the total amount of wire, turn to the number of outlets of all descriptions, and in the case of the conduit, add not less than 4 ft. of wire per outlet, this being on a basis of 2½ conduits average per outlet, which is a fair figure to assume. Similarly with respect to the armored conductor, add 2 feet per outlet. In figuring outlets in this connection, do not overlook junction boxes and the circuits entering the distribution box.

Returning to our estimate sheet, we are now in a position to put down the number of outlet and junction boxes, the number of blank iron covers, the quantity of ½-inch conduit, the quantity of two conductor steel armored cable and also of three conductor, together with the amount of two braid rubber covered wire.

If the wiring is that of an old building, and this is what we are assuming, and there are gas fixtures in the house, it will be necessary to figure dead ground clamps at each outlet where there is a gas pipe. We find there are 15 in the present building.

In figuring locknuts and bushings, while these can be counted and the exact quantity arrived at, in practice it is usual to take as a basis 2½ conduits per outlet as above noted. In the case of work involving large conduits, it is best to count the number.

To the total quantity of steel armored conductor figured on the above basis, we will add 10 per cent. This covers not only waste material, but the extra amount of material used in running through floor joist, and which is greater than could be actually scaled. Allowance should also be made for additional material required through being obliged to run around obstructions that may be encountered. As a general rule, 10 per cent. will take care of both these items.

We have now covered all the detailed items of the estimate, which can be directly taken from the plans. Before coming to the labor, however, we note several items which we must not overlook. The system must be permanently and effectually grounded. We therefore add an item for ground connections, and in a building of this character and size $1.00 under the average conditions would cover the cost of the work. We will also require pipe straps, certain screws, together with nails for relaying floor, etc. Consequently, we add for this item.

In this same connection, we must add for tape and solder, the amount of which in a given case will depend entirely on the size of the job. Under this same head would come also the question of fares and cartage, this item being determined entirely by local conditions. All of these items, however, are almost invariably found in greater or lesser degree on every job and it is well to make note of them.

The final item on the estimate, and the one which should properly come last, is the question of labor. Unquestionably all other items on the job being susceptible to exact estimating, any system which will tend to bring the labor under a similar head is to be highly desired. The labor item on a job is doubly important, since it represents a relatively large proportion of the total cost. For this reason, some unit cost method of figuring labor, or a definite system of estimating it, should invariably be followed.

Keep Careful Records

Perhaps in the end, the final answer to this question is to be obtained in a careful system of keeping records of the jobs, and comparing each new job with other similar jobs taken from your records. In this way, the error in the labor item can be reduced to a minimum.

In the kind of a job we have before us, experience shows for the ordinary type of residence with flexible steel armored conductors, the total amount of two and three wire conductor divided by one hundred runs very close to actual results. In other words, five hundred feet of two and three wire conductor would represent five days labor for a man and helper. This would include the installing of the boxes at the outlets, receptacles, switches, etc., together with the placing of these switches and receptacles. To this should be added the labor of installing any rigid conduit, together with the main switch and distribution box and meter loop. As a general average, 90 to 100 feet of ½-inch and ¾-inch conduit is a proper figure for a man and helper per day. This would allow for the installing of the main switch and distribution boxes, the meter loop, and the service conduit on the outside of the building, together with the pulling in of the wire.

On this particular job, therefore, we put down 5½ days for running the two and three wire flexible conductor, to which we add 1½ days for the ½-inch and ¾-inch rigid conduit involved in the service, subfeeders and meters, or a total of seven days for man and helper.

The figures given for costs of materials are taken from

the N. E. C. A. Universal Data and Sales Book, and while they may vary, of course, in individual cases, they are fairly typical for the purpose of this article. On this basis, therefore, we arrive at our total cost of $120.25. If we assume we want to make a net profit of 10 per cent. on all our work, and our overhead expense is 17 per cent., we find on turning to the table for figuring net profits, that if we add 40 per cent. the job would net us 11 3-5 per cent. profit. On this basis, therefore, we arrive at a figure of $168.35 and submit our bid for $168.00.

Desiring to check this figure to be sure we have not made any serious mistakes, we turn to our detailed schedule of outlets, etc., and find we have 12 centre, 12 side and 5 surbase outlets. Also 14 switches. We note in the switches, 8 are single pole and the remaining 6 are either three way or electrolier. Allow 1½ for each three way and electrolier switch since these represent quite a little additional cost. Our 14 switches on this basis, therefore, become 17, which added to the outlets and receptacles give us a total of 46 outlets figured on this basis. Dividing the total cost of the job, $168.00, by this, we find the price for the job figures approximately $3.65 per outlet, which is a fairly typical figure for work of this character. Had this figure come out $4.50 or $2.25, or some similar figure, our attention would immediately be drawn to the possibility of a mistake in the estimate. In this way the check figure being quickly applied, is valuable.

In conclusion, would say given a hundred different men to figure a job, while the results would undoubtedly be very close, there would possibly be almost as many different methods employed in reaching that result, as there are men figuring it. This present method is suggested as being reasonable, safe, and it is believed accurate. It also has the advantage of indicating a definite system which after all is the final thing to be desired in any method of estimating.

Moved to New Headquarters

The Stuart-Howland Company recently moved into their new headquarters at the corner of Congress and Purchase Streets, Boston. The growth of the business of the company as a distributor of electrical supplies from its beginning fourteen years ago has been quite phenomenal and its recent move indicates further expansion notwithstanding the general business depression. This new building, six storeys and basement —with both freight and passenger elevators—gives ample space for the present and at least for some time in the future and is admirably adapted for quick and efficient handling of goods which should tend to make shipments even more prompt than in the past.

Construction of Electrical Machinery in Japan

Up to the present, most of the dynamos and other electrical machinery in Japan have been supplied by American, English, and German firms. The Tone Electric Company, however, is said to have ordered the construction of three dynamos, of 6,000 kilowatts each, in Japan. These machines are to be made by the Hitachi Works, and iron pipes for the same power installation are to be made by the Shibaura Works.—Daily Consular & Trade Reports.

Personal

Mr. H. C. Barber has recently joined the sales force of the Standard Underground Cable Company of Canada, Hamilton, Ont. Mr. Barber is a graduate of the Faculty of Applied Science and Engineering of the University of Toronto and since graduation has occupied important positions on the engineering and executive staffs of the Toronto Hydro-electric system, and the Hamilton Hydro-electric Department; also on the sales force of the Packard Electric Company of St. Catharines, Ont. His education and experience fit him thoroughly for his duties as salesman for the Standard, which company manufactures a complete line of electric wires and cables, cable terminals, junction boxes and other cable accessories. Mr. Barber is also well fitted to serve his customers by advising them in regard to their installation problems.

Trade Publications

Single phase motors—Folder issued by the Century Electric Company, St. Louis, Mo., describing and illustrating Century single phase motors.

Steel City Electric Company—Bulletins No. 25, 26, 27 and 28, dealing respectively with "Superior fish wire," "Star fixture stems and beam straps," "Steel City outlet boxes for concrete work," and "Conduit bushing adaptors and hickey fixture hangers."

Eureka Vacuum Cleaner—Folder issued by the Onward Manufacturing Company, Berlin, illustrating recent improvements in the well-known Eureka cleaner.

Small Motors—Folder No. 21, issued by the Westinghouse Electric and Manufacturing Company, of East Pittsburgh, Pa., describing the advantages of Westinghouse small motors. Other folders issued by this company are entitled, "For better protection"; "Motor driven bakers' and confectioners' machinery"; "Type MP lightning arresters"; "D.C. motors for driving job printing presses"; "Westinghouse low pressure turbines"; "Large slip-ring induction motors, type CI"; D.C. motors, effective for group drive of sewing machines"; "No. 328 commutating pole railway motor"; folder describing the type OA single phase Westinghouse watt-hour meter.

Ornamental Standards and Brackets—New bulletin E of the Electric Railway Equipment Company, Cincinnati, O., describing and illustrating single light lamp standards and brackets to be used for supporting type C high efficiency lamp.

Testing Volt-ammeters—Bulletin Sheet No. 86, issued by the Roller-Smith Company, 203 Broadway, New York, illustrating and describing their signal system testing volt-ammeters.

The Curtis Portable Lamp—A very handsome catalogue issued by the National X-Ray Reflector Company, Chicago, illustrating a number of types of this company's indirect lamp and portraying a number of rooms equipped with these units.

Car Equipment—Volume 9, No. 3, of the O.B. Bulletin published by the Ohio Brass Company, Mansfield, O. The bulletin describes many products of this company, and also contains brief descriptions of installations where O.B. material has been chiefly used.

D.C. Generators—Bulletin No. 111, second edition, issued by the Robbins and Myers Company, Springfield, O., describing their type S steel frame direct current generators.

Reco Motors—Bulletin No. 201, describing a new line recently added by the Reynolds Electric Company, Chicago.

Cranes and Hoists—Booklet issued by the Northern Crane Works, Limited, Walkerville, Ont., illustrated, showing a number of the company's equipments and a few Canadian installations.

Aluminum Conductors—Booklet issued by the Northern Aluminum Company of Canada, entitled "Aluminum for electric conductors." This booklet is in effect a treatise on the use of aluminum for power and transmission lines, railway feeders, electric light wire, and busbars. A number of valuable tables are included, setting forth the properties of aluminum wire. A section of the booklet is devoted to "steel core aluminum cable," and another section to "splicing of aluminum cables."

What is New in Electrical Equipment

Northern Electric Hughes Electric Ranges

The use of electricity for cooking has increased very rapidly during the past two or three years. The Central Stations have realized the value of such appliances to build up a steady load, and one which has its peak during what are usually the valley hours. The Northern Electric Hughes Ranges include a most complete line of electric cooking appliances, covering the large hotel ranges to the very small two and three burner ranges for the small house or apartment. Particular attention is called to the latest Northern Electric Hughes Range No. 17 which has been brought out to meet the demand for a small, cheap, but high quality electric range, having an oven capacity of three loaves of bread, or a 10-lb. roast, and, with the oven removed, has two open range burners. This range was illustrated on page 46 of our January 1 issue.

When cooking is done by electricity, it is clean, odorless, and absolutely safe, and it has been proved by test, that owing to the absence of odors such as are had from gas or coal stoves, the flavor of the food is very much bettered.

Practical Wire Connector

We illustrate herewith a new wire connector, which has been found so uniformly effective by the Canadian contractor, that it has been given the forceful nick-name the "Red Devil." This connector will hold the wire as firmly as a vice, leaving the right hand free to make the twists. The tool is made to receive two round wires and hold them, either steel, iron or copper, sizes 8, 10, 12 or 14. For use with larger wires or sleaves, special openings are provided to accommodate either iron or copper wire. This connector is also made for McIntyre waterproof joints, Holtzer-Cabot seamless

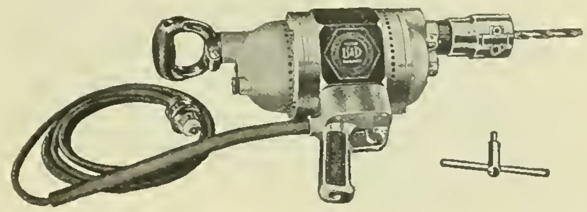
New connector by Smith & Hemenway.

joints, or American Fuse Company's joints. These are commonly known as McIntyre sleaves, in which the wires are drawn together, while the sleave is slipped over the connector, thus holding it firmly during the twisting and excluding the water that would otherwise either rust or corrode the wires.

This tool is spring tempered from end to end, has a milled and counterboard joint, is hardened and tempered like an auto bearing, and cannot get out of line. Like all Red Devil tools, it is built for a purpose. 38 different styles of this make of connector can answer every possible requirement of the line The Red Devil is manufactured by Smith and Hemenway Company, 106 Chambers Street, New York.

A New Portable Electric Drill

The drill illustrated herewith is suitable for all drilling services where a revolving tool can be used. The design is such as to make it convenient for drilling in corners, or up close to obstructions. The drill is so shaped and balanced with relation to the grips that it is easy to handle. The control is unique and effective, being similar to that of an automatic pistol. One finger does the work and consequently the grip on the outfit and the aim is not obstructed in operating the control. This prevents breakage of drills and enables the operator to drill more accurately than he can with a tool where it is necessary to release his grip to turn the switch, or press a button to control the drill. The housings of the drill are cast from a special high duty aluminium alloy having a high tensile strength and resistance to distortion, making the outfit light in weight and easy to handle. The gears are of nickel steel, heat treated to give them long life, and are cut from the solid. The chuck spindle is hardened and ground. It runs in a special high speed bronze bushing and the end thrust is taken care of by a ball thrust bearing. Separate means for both oil and grease lubrication are pro-



Portable electric drill, Robbins & Myers.

vided, and all gears are constantly bathed in non-fluid grease in a grease tight compartment. The motor is universal and operates on both direct and alternating current. It is manufactured by The Robbins & Myers Company, Springfield, Ohio. It is liberally proportioned and will carry heavy overloads. A forced draft ventilating system insures cool operation under overloads. The commutator and brushes are readily accessible. The bearings and brushes are carried on a separate inner spider which is protected from the external strains which tend to cause binding in the bearings. This construction permits inspection of the commutator and brushes while drill is running. The outfit is made in two sizes for operation on 110 and 220 volts. It is manufactured by The Black & Decker Manufacturing Company, Baltimore, Md.

Keeps Your Engine from Freezing Up

The illustration herewith represents a new piece of equipment just placed on the market by Templeton & Company, of 19 Jarvis Street, Toronto. This is a little electric heater, specially designed for keeping the temperature of the engine of an automobile above the freezing point of the liquid contained. The company advise that this new article is being

Prevents freezing—Uses only 100 watts.

well received and that at the low price charged a considerable demand has already developed. This unit occupies practically no space in the hood of the engine, being only about an inch and a half in diameter. The standard length is 15 inches, though other lengths may be obtained if desired. A larger unit consuming 200 watts is also being manufactured.

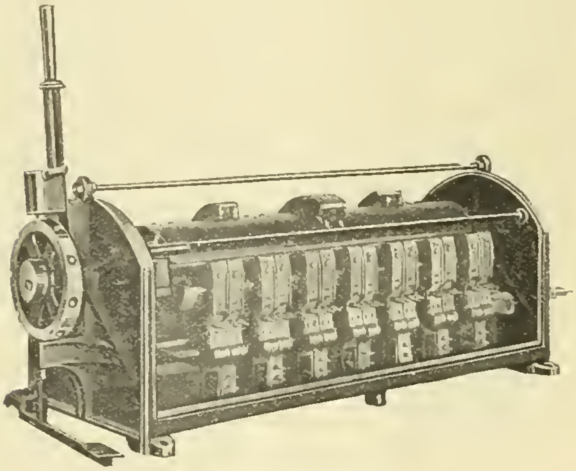
Trade Inquiry

Name and address of inquirer may be obtained from the Electrical News.

1295. **Electric shades, etc.**—A Newfoundland commission agent desires to represent a Toronto manufacturer.

Large Drum Controller

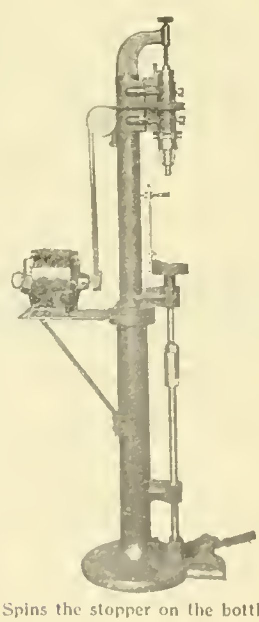
The controller illustrated is said to be the largest drum controller that has ever been built. It was furnished by the Industrial Controller Company, formerly the Independent Electric Manufacturing Company, of Milwaukee, for use in connection with an electric steel melting plant. This drum controller is 8 ft. 6 in. long by 3 ft. high, and weighs approximately 5,000 lbs. It is impossible for a man to turn the cylinder of this drum by means of a standard drum handle, and a special ratchet arrangement was built for operating the cylinder. The fingers of this drum are of cast copper, having removable tips and each of the 28 fingers weighs sixteen pounds.



Largest controller to date.

Electric Stopper Spinning Machine

The demand for bottles of the non-refillable type has led to the development of the machine illustrated herewith, which is used for spinning simplex protective stoppers into the neck of bottles. These stoppers consist of a copper cage which is heavily silver-plated and which carries a plated ball about ⅜-in. in diameter. The bottle is placed on the stand which is raised to meet the spindle which spins the stopper into the grooves in the neck of the bottle. When spun in place it is impossible to remove this stopper without destroying the bottle and the bottle becomes practically non-refillable. Experiments under the most favorable conditions in a laboratory, demonstrated that over one-half hour was required to fill one of these protected bottles by the vacuum process. The machines are driven by ¼ and 1-6 horse-power, direct and alternating current motors manufactured by The Robbins & Myers Company, Springfield, Ohio, and the spinning machine and stoppers are manufactured by the Simplex Protective Stopper Company, Baltimore, Md.



Spins the stopper on the bottle.

Bag-on-Handle Sturtevant Cleaner

A new Sturtevant vacuum cleaner of the Bag-on-the-Handle type has been developed and is to be placed on the market at once. This cleaner is the last of a series of 17 which the Sturtevant company have already built. Besides the Bag-on-the-Handle cleaner, they have six other sizes of portable machines and nine sizes of stationary cleaners. This cleaner is shown herewith and it will be noticed that it is easily handled. The wheels enable the operator to shove it around with scarcely an effort. There is a special thread lifter which is attached to the outlet of the tool used for cleaning carpets and floors. This enables the machine to pick up lint or thread in any quantity, even from carpets which are very hard to clean. It permits perfect cleaning to be done under all circumstances. There is also a special starting switch which will be seen near the top of the frame just below the handle. The B. F. Sturtevant Company of Canada, Limited, are manufacturing all sizes of these cleaners at their works in Galt, Ontario, and are appointing dealers and agents in all of the cities.

The last of seventeen.

Electrical Manufacturer Exhibits at Automobile Shows

The Cutler-Hammer Manufacturing Company, Milwaukee, had an interesting exhibit at the New York Automobile Show which opened January 2nd. The principal device shown was the electric gear shift for gasoline automobiles which was mounted on a Winton transmission. The operation of this device, which eliminates the hand shifting of gears, is controlled by push buttons mounted in the centre of the steering wheel. The Winton Six is one of the 1915 cars to be furnished with electric gear shift. C-H single button push-and-pull automobile lighting switches are shown in various combinations for the control and dimming of automobile lights. Cutler-Hammer Pyroplax fireproof insulating material is also shown and samples of such parts as radiator caps, switch sub-bases, fuse boxes, motor terminal blocks, etc., are mounted on a display board. A similar exhibit will be made at the coming Chicago automobile show.

The Water Power Branch of the Department of the Interior has issued a report of the hydrographic survey of the railway belt of British Columbia. This report is designated Water Resources Paper No. 1 of the Dominion Water Power Branch.

The Radiant Sign Company, Limited, has been incorporated with head office in Toronto and capital $50,000.

Service Transformers

A new line of service transformers has just been put on the market by the Moloney Electric Company of Canada. The accompanying cut illustrates the smaller sizes up to 15 kw. Special attention has been paid to ensure a pleasing appearance and convenience and, at the same time, the efficiency and long life that has always been a characteristic of this line of transformers. Among other features the primary

Moloney Service Transformer.

and secondary bushings are worthy of notice. The secondary leads are brought out of the case through a single heavy porcelain block. The primary bushings are very heavy, the part projecting from the case being spherical in shape. These bushings are leaded into the pockets and set at an angle so as to throw the leads away from the sides of the case. The absence of sharp corners or edges and the heavy sections give the maximum of permanent insulation efficiency and freedom from danger of fracture in shipment and installation.

Northern Electric Conlon Washing Machines

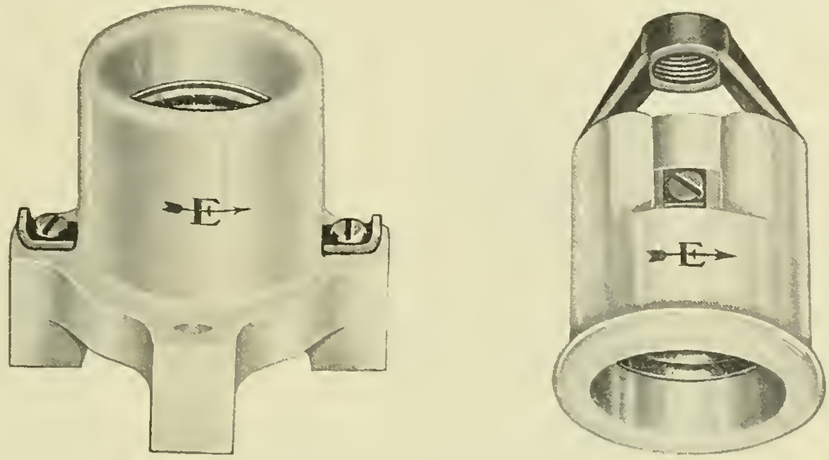
A strong and popular demand for an electric washing machine of simple yet strong construction combined with length of service and ease of operation has been adequately met by the Northern Electric Conlon Washing Machine. This machine is of very simple yet strong design, and can be operated by any person without the possibility of trouble developing, or the necessity of repair bills. The machine is furnished with either a galvanized or copper finish. All working parts are enclosed, eliminating danger of accidents, and the operation of the machine is the well-known cylinder operation such as is used in all the large laundries. The washer is directly driven from the motor, eliminating any waste of power, and a large family washing can be done at a surprisingly low cost. Particular attention has been given to the size of the machines, and they are so designed as to be very easily moved and to take up as little floor space as possible—a most important consideration with residents of apartment houses where space is limited.

Sole Distributors for Canada

The Chas. B. Ellis Company, 301 Power Building, Montreal, have been appointed sole distributors for Canada of the "Bright Eye" Electric Lantern Attachment manufactured by the Burchwell Manufacturing Company, St. Louis, Mo., and illustrated in the January 1 issue of the Electrical News. The "Bright Eye" slips on over the top of an ordinary No. 6 dry cell and is held in place by the battery thumbscrew. It is made of solid brass, brushed, finished, and weighs but five ounces. The manufacturers state that it will give a light for 24 hours when completely submerged in water.

New Socket and Receptacle

A new socket and receptacle for Mogul Base Lamps are shown in the accompanying illustrations. The socket with yoke is of the same overall length as the brass shell Mogul sockets already on the market and can be used with fixtures already designed for these brass shell sockets. The receptacle shown here is adapted for exposed wiring and is so designed that the porcelain lugs projecting below the bottom

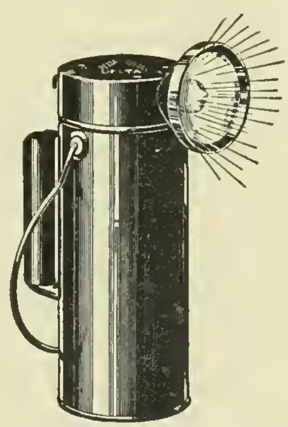


Socket and Receptacle for Mogul base lamps.

surface of the receptacle allow an air space between the receptacle and the surface to which it is attached. Both of these devices are particularly adapted for use with the new Type "C" high-efficiency lamps, and are manufactured by The Arrow Electric Company.

New Reflector Idea

Announcements are being sent out by the Delta Electric Company, Marion, Indiana, manufacturers of electrical specialties, describing a powerful, new reflector now being used on the Delta Electric Hand Lamp. The Model Department of this company claim to have encountered an unusually ef-



Delta lamp and reflector.

fective combination existing between the curve of the reflector and certain construction details in the lamp. By working the two together, they succeeded in creating an intensified power of projecting light. With the lamp stationed 200 ft. away, a newspaper was found easily readable. At a distance of 400 ft., it is claimed, the bright glare of the light appeared as intense as from a powerful automobile headlight. The Delta lamp operates on a single dry cell as illustrated.

Another Condor Product

It is announced that the name of the C. H. Basters Company has been changed to The Basters, Jackson Company, though the personnel of the company remains the same, Mr. Jackson having been previously a silent partner only in name. The address of the firm of course remains the same, 22 College Street, Toronto.

With the new name comes also a new Condor product,—the Condor reflector lamp, illustrated herewith. This is an efficient tungsten lamp with a separate reflector of highly polished porcelain which fits closely over the base of the lamp, as shown in the illustration, and so directs all the light away from the base. The shape of the filament, which is almost a circle, adds further to the efficiency of this new unit.

Condor lamp with separate reflector.

The Basters Jackson Company are now ready with their new Condor nitrogen lamp which has been under way for some time and has been given the most severe tests during the past few months preparatory to placing it on the market with a liberal guarantee behind it. This lamp, it is confidently expected, will maintain the same high standard which the other Condor lamps have established in Canada.

Opened Up New Office

The Trumbull Electric Manufacturing Company, manufacturers of supplies, Plainville, Conn., announce that they have opened up their new San Francisco office at 595 Mission Street, San Francisco. Mr. W. P. Naser, for some years western representative of this company, and who is thoroughly familiar with the needs and the spirit of the west, will be in charge. A large line of Trumbull T material will be carried in stock, and all ordinary requirements for the trade on the Coast can be nicely taken care of.

Also Making Ornamental Poles

During the past year the Wm. Hamilton Company, Limited, of Peterborough, manufacturers of hydraulic turbine machinery, have added to their activities the manufacture of ornamental street lighting poles. The company have taken up this line actively and have prepared a number of designs for the different forms of street lighting and sold installations to numerous cities.

"Made in Canada" Utilities

The two illustrations herewith are typical of the products being turned out by the Renfrew Electric Manufacturing Company, Limited, of Renfrew, Canada, and are worthy of the "Made in Canada" standard that our manufacturers are attempting so successfully to uphold. Fig. 1 represents the "Canadian Beauty" electric luminous radiator with foot warmer attachment. This has a distinct advantage over other makes, inasmuch as the foot warmer is heated by a separate unit, which adds just that much to the utility of the radiator. With the gradual reduction in the prices of electric current supply, equipment of this nature will be very generally used, in spring and fall, at least, and our dealers, we believe, will be well advised in stocking them and pushing their sale. Fig. 2 represents the Canadian Beauty radiator or air warmer. It is a neat, graceful design, beautifully finished in polished nickel and burnished brass throughout and makes a real ornament in any room. This unit is supplied with a three heat attachment, which enables the user to regulate the heat for moderate or cold weather. The smaller size unit consumes 300, 600 or 1,200 watts and a larger size, 500, 1,000 or 2,000 watts.

Fig. 1.

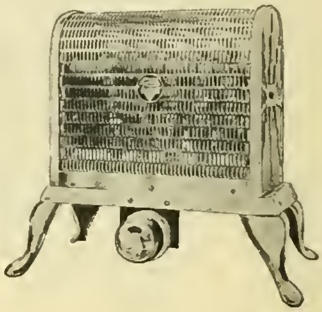


Fig. 2.

The electrical contractor will do well to keep it in mind that equipment such as that illustrated in Figs. 1 and 2 are daily becoming more general and that no house should be wired without base outlets being supplied, which will admit of the ready use of appliances of this nature in every room.

Klaxon Automobile Horns

The Northern Electric Company, Limited, has been appointed distributor for the well-known Klaxon automobile and motor boat warning signals, and are carrying a complete and representative stock of these instruments at all of their branch houses. A very attractive proposition for dealers handling this line can be had on application to the nearest branch office of the Northern Electric Company. With the large reduction in the price of these horns for 1915, there is good opportunity for working up a large business in these well-known signalling devices.

Will Handle Push Switches

The Trumbull Electric Manufacturing Company, Plainville, Conn., have taken on two new lines recently—armored cable and push switches—the latter of which will be ready to market early in the year. This company advise that they are finding Canadian business very prosperous and the prospects of the coming year are excellent.

Armours Limited, in Larger Quarters

Armours, Limited, electrical jobbers, have moved their offices from Fairmount Avenue to the Board of Trade Building, Montreal. The company are agents for the Tallman Brass & Metal Company, Hamilton, Ont., and the U. S. Gas Fixture Company, New York.

Current News and Notes

Bothwell, Ont.

A by-law was carried on January 4th authorizing the council to enter into a contract with the Hydro-electric Power Commission of Ontario for a supply of electric power.

Brockville, Ont.

It is anticipated that a by-law will be submitted by the Council asking authority to make temporary arrangements to obtain $73,000 in connection with municipal electrical and other local improvements.

It is probable that the electric distributing system will be extended west of this town to the summer resort area and a number of the larger farms, including Mr. A. C. Hardy's "Avondale."

Chatsworth, Ont.

A by-law was carried January 4th, authorizing the council to enter into an agreement with the Hydro-electric Power Commission of Ontario for a supply of power.

Delaware, Ont.

A by-law was carried on January 4th authorizing the council to enter into a contract with the Hydro-electric Power Commission of Ontario for a supply of electric power.

Dundalk, Ont.

A by-law was carried on January 4th authorizing an expenditure of $5,000 on a distributing system, the power to be supplied by the Hydro-electric Power Commission of Ontario.

Durham, Ont.

A Hydro-electric by-law was carried on January 4th by a good majority.

Embro, Ont.

Hydro-electric power supplied from Niagara was turned on in Embro, on Tuesday, December 29th.

Hamilton, Ont.

The Hydro-electric Commission of Hamilton announce that the year just completed closes with 10,116 customers divided as follows:—residence, 8,404; commercial, 1,375; power, 337. The total connected load, exclusive of the waterworks pumping motor load, is approximately 16,000 h.p.

Following the conference between the local Hydro Commission of Hamilton and the Hydro-electric Power Commission of Ontario, a further reduction of rates by the giving of an extra 10 per cent. discount will be made in Hamilton over those rates published in the January 1st issue of the Electrical News. It is understood that Hamilton has decided to adopt a minimum charge of 50 cents as part compensation for the investment in wire and meter, in case no current is consumed during any month.

Hawkesbury, Ont.

The Canadian Industrial Bond Corporation, Limited, are making issue of $125,000 of the Hawkesbury Electric Light and Power Company 6 per cent. mortgage sinking fund gold bonds. The Hawkesbury Electric Light and Power Company was formed in 1901 for the purpose of developing power at Table Falls, on the Rouge River, in the Province of Quebec. The power development was 1,500 horse-power, for which there was a ready market. In 1910 the company purchased a second power site about five miles farther up the Rouge River, and in 1912 it was decided to develop this additional site, and construction is now nearing completion. This new development will give the company an additional 4,000 horse-power which can be increased to 6,000 horsepower, provision being made in the power-house for another unit of 2,000 horse-power. Contracts have been signed for over fifty per cent. of the additional capacity. The bond issue is being made to provide funds for repayment of bank advances obtained to start construction of the new plant and to complete same. The company is supplying the towns of Hawkesbury, Vankleek Hill and Calumet and lights the Grenville Canal under contract, with a further demand from the town of Alexandria, which they have been unable to supply.

Ilderton, Ont.

The London Township Council have decided to install electric light and power in the village.

Kincardine, Ont.

A by-law was recently passed by the town council authorizing the payment of $2,500 to meet the interest due on the bonds of the Ontario West Shore Railway.

Kingston, Ont.

A by-law granting permission to Mr. J. M. Campbell's company to erect poles and string wires over certain of the Kingston city streets, supplying electric power from Kingston Mills to local industries was carried on January 4th.

The Gananoque Electric Light & Water Supply Company, Mr. J. M. Campbell, president, who at the recent election were given authority to construct a transmission line along certain streets of the city of Kingston for the supply of power, are at present constructing a hydro-electric plant at Kingston Mills. At present only one unit is being installed of 900 h.p. capacity, but the power house is built for three such units, which is the ultimate capacity of the river at this point.

Medicine Hat, Alta.

The new automatic telephone system was placed in commission on the 1st of January, and the rates increased from 20 to 40 per cent. The telephone subscribers of the city have protested against the increase in rates, which, they claim, is unwarranted under present conditions and will operate against the welfare of the system, as many subscribers will discontinue under the conditions of higher rates.

Montreal, Que.

The city of Roberval, P.Q., will issue debentures for $45,000 for the construction of an electric lighting system.

Sir Herbert Samuel Holt, K.B., is one of the new Canadian Knights announced in the New Year's honours list. He is known throughout the Dominion as a successful financier, particularly in connection with electrical and other industrial enterprises. By profession he is a civil engineer, and received his training in Ireland, having been born in Dublin in 1856. Sir Herbert came to Canada in 1875 and for several years was engaged in superintending the construction of railways. He is president of the Montreal Light, Heat and Power Company, and of the Kaministiquia Power

UNDERGROUND CABLES

LOW AND HIGH TENSION

FOR LIGHTING,
POWER,
STREET-
RAILWAYS,
TELEPHONE,
TELEGRAPH.

ARMOURED CABLES FOR STREET LIGHTING, PAPER INSULATED CABLES OF ALL DESCRIPTIONS, RUBBER INSULATED CABLES &c.

Also Bare and Weatherproof Wires and Cables, Magnet Wire, Flexible Cords, &c.

Galvanized Iron Wire and Strand

HEAD OFFICE:

MONTREAL, CANADA

BRANCHES:

Toronto, Winnipeg, Halifax, Vancouver.

Company, and director of the Cedars Rapids Manufacturing and Power Company, Shawinigan Water and Power Company, and Canadian General Electric Company.

The plant of the Cedars Rapids Manufacturing and Power Company is now in operation, supplying power over the Montreal transmission line for the Montreal Light, Heat and Power Company and also over the Massena, N.Y., transmission line. Prior to this the lines had been carrying current for test purposes.

The G. N. W. having taken over the operation of the telegraph lines of the Canadian Northern Railway, have appointed Mr. L. S. Hume, formerly Montreal manager for the G. N. W., district superintendent, with jurisdiction over all offices in New Brunswick, Quebec and Ontario, east of Kingston. Mr. Hume's headquarters are at Montreal. Mr. J. E. McCann, formerly assistant local manager, assumes the position of office manager at the Montreal office.

The Radio-Electric Company of Canada, Limited, Montreal, have supplied the Dominion Government with two wireless outfits, made in Canada. These are intended for field service, and can be carried on horseback. In a test made at Ottawa the wireless apparatus was installed in an hour and fifteen minutes.

The City Electric Contracting Company have registered in Montreal, Que., proprietor, Mr. J. Albert Parent.

The Canadian Car and Foundry Company are arranging for the opening of a London office, for the handling of their trade with India, Africa, Australia and the Far East.

Mount Forest, Ont.

A Hydro-electric by-law was carried on January 4th by a good majority.

Newmarket, Ont.

The ratepayers again defeated the Hydro-electric by-law which would have authorized an expenditure of $15,000 for a distributing system.

Oakwood, Ont.

Hydro lights have just been installed on Tay Avenue, Oakwood, Ont.

Orillia, Ont.

The Water, Light and Power Commission of Orillia have presented the citizens of that town with a nice New Year's present in the form of a cut in electric rates, which amounts to a reduction of approximately 10 per cent. The domestic flat rate, which is in use in certain cases, is reduced from 25 cents to 22½ cents gross for a 60-watt lamp, which amounts to net from 20 to 18 cents. The commercial flat rate is reduced for a 60-watt lamp from the net rate of 24 cents to 22 cents. The domestic meter rate is reduced from 10 cents for the first 1,000 watts per lamp and 7½ cents thereafter, to 10 cents and 5 cents respectively, with the meter rental abolished A minimum charge of 5 cents a month for each outlet is made. Proportionate reductions were made in power rates. It is estimated that the reduction will effect a saving of some $7,000 a year to the power users.

Ottawa, Ont.

Application will be made to the legislative assembly of the province of Ontario at its next session, to change the name of the Ottawa and St. Lawrence Electric Railway Company to the Ottawa & St. Lawrence Railway Company, and that power be given to operate by means of steam or other motive power. Extension of time is also asked, in which to construct the company's lines.

The Globe Electric Machine Company, Limited, has been incorporated with capital $40,000 and head office in Hamilton.

Shelburne, Ont.

A by-law was recently carried authorizing the expenditure of the sum of $15,000 on an electric distributing system.

Strathroy, Ont.

The town council have decided to install about 50 more lamps in the street lighting system.

St. Marys, Ont.

The secretary of the local Water, Light and Heat Commission has prepared an estimate on the cost of extending the transmission line to Rannock. The estimate is $20,000 per mile, including poles, wires, etc.

Toronto, Ont.

At the meeting of the board of directors of the Canadian General Electric Company, held recently, Col. the Hon. J. S. Hendrie, Lieut.-Governor of Ontario, was elected to fill the vacancy caused by the death of Senator Jaffray. At the same meeting an appropriation of $50,000 was set aside to cover expenses of maintaining the electrical engineering corps of the Canadian General Electric Company, which was recently sent to the front, and kindred objects.

Construction work on the erection of the new civic car barns on Bloor Street West has been started. It is planned to operate the new line from the Edwin Avenue sub-station.

Of all the municipalities which voted on by-laws authorizing contracts with the Hydro-electric Power Commission of Ontario, Newmarket again was the only one to stand out against the government proposition. In the following localities the by-law was carried by good majorities, amounting, in certain instances, to practically a unanimity in favor of the government scheme: Durham, Sandwich, Delaware, Dundalk, Huntsville, Bothwell and Shelburne. In Newmarket the situation is entirely different, owing to the presence of the Toronto and York Radial Railway Company, who are in a position apparently to supply power at a rate equal to or possibly lower than the Commission can hope to do. At any rate, lines of the company are already in Newmarket while the lines of the Commission have yet to be constructed. It is understood that the failure of Newmarket to pass the by-law cannot interfere in any way with the general radial and power distribution scheme of the government.

Vancouver, B.C.

City electrician Fletcher will submit a report on the proposed extensions to the heating plant at the Police Station. It is suggested that a sufficient amount of electric power might be generated to light the various civic buildings.

Victoria, B.C.

The city of Victoria added 80 lights to the arc system during 1914 and have now a total of 850 arc lamps in use. The tungsten cluster standards number slightly over the 1,000 mark.

West Toronto, Ont.

The Toronto Suburban Railway Company are installing a telephone despatching system on its Weston to Woodbridge division.

Ymir, B.C.

It is reported that the company operating the Yankee Girl mine is planning the construction of a hydro-electric plant at Wild Horse Creek This would supply sufficient power for the company's new requirements and would also be used to light the town of Ymir.

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Generation, Transmission and Application of Electricity

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Conserve Our Water Powers

Elsewhere in this issue we publish a paper dealing with the Niagara Power situation as an international question. At the outset, the author, Mr. Arthur V. White, one of our government engineers, defines the situation as "complex," and, as evidence of the complexity, quotes much interesting material bearing upon the possibility of international complications. He tells us that "the chief danger lies, not with the people themselves, but with the aggressiveness of powerful United States' commercial interests whenever they fear that their assets are jeopardized."

Mr. White discusses two Bills which have been presented to the United States Congress, which if enacted "will be of serious import to Canada." As Mr. White intimates, the growing demands of Canadian factories are causing concern on the other side of the border, and it is the open intention of those who are bringing forward these Bills, to import into the United States largely increased quantities of power, generated in Canada. Of the various statements and reports referred to by Mr. White, none is more illuminating than that of Lt.-Col. Sanford, a United States engineer who is quoted as follows:—"There is no question but that Niagara power will soon be utilized to the fullest extent allowed by governmental restrictions. If advantage of the power, generated in Canada, cannot be had on the American side, manufacturers will be attracted to Canada by this cheap power, and the industries of this country will suffer accordingly. The effect of present restrictions on the importation of power is becoming noticeable. . . . . Manufacturers at present contracting for additional Niagara power must locate and are locating in Canada."

While using every honest effort to avoid international complications, Canada must adopt protective measures and secure the unhampered development of her industries. It is gratifying, therefore, to learn that the Commission of Conservation have given the most careful consideration to this problem and that they are alive to the many troublesome possibilities which surround one of Canada's greatest national assets.

Toronto's Final Rates

The Toronto Hydro-electric System have announced their revised rates, which will be in force for the year 1915. They are materially different in some respects from those issued in our January 1st number, and now conform to the uniform system of charging adopted by the Hydro-electric Power Commission of Ontario throughout their entire area.

A noticeable feature of the system of charging as adopted originally by the Toronto Commission was that the small consumer received due consideration. As the present rates stand, the minimum floor space charged is 1,000 sq. ft., so that the electric light bills of a great many of Toronto's workmen will be increased over what they were a year ago. On the other hand, the well-to-do population, living in larger residences, will have a very nice slice clipped off their bills. The policy of "To him that hath shall be given, and to him that hath not shall be taken away, even that he hath" was never better exemplified than in these new Toronto rates. The rates follow:—

Residence—a service charge of 3 cents per 100 sq. ft. of floor area, with a minimum of 1,000 sq. ft. and a maximum of 3,000. To this is added a meter charge of 2.8 cents per kw.h. for all consumption up to an amount equal to 4 kw.h. per 100 sq. ft. for the first 1,000 sq. ft., and 3 kw.h. for each additional 100 sq. ft. of floor area as charged. For all consumption above this amount, the rate is 1.4 cents per kw.h. 10 per cent. discount is allowed for prompt payment.

Commercial lighting—6 cents for the first 30 hours use per month of connected load, 2.8 cents for the next 70 hours use of connected load, and .6 cents for all in excess. Ten per cent. discount for prompt payment.

The power rates, we understand, have not been finally adjusted.

Trade With Australia

A report of the Department of Trade and Commerce, Ottawa, dated January 4th, contains the following item with reference to an opening for export trade in Australia:

An Australian firm writes the Department stating that they have been closely and extensively identified with general lighting and heating business in gas, electric and oil of all descriptions throughout the Commonwealth of Australia and New Zealand. Their principal supplies have hitherto been obtained from Germany and Austria and in view of recent events the directors have decided in future to confine the operations of the company to goods manufactured in the Empire. The company is therefore desirous of immediately getting in touch with manufacturers in the above lines.

In addition to the above they state that they are already identified with the general hardware trade and are open to negotiations for agencies of special lines contingent to that business especially from manufacturers of engineering and similar lines.

It is suggested that any firms who communicate should send full catalogues with complete export price lists and details of what is offered. It is probable that one of the directors of the firm will next year visit the Panama Exposition and at the same time take a tour through Canada which

would give the opportunity of personally interviewing firms with whom communication has occurred. They consider the present time an excellent opportunity for Canadian manufacturers in Australia. Canadian firms desiring business of this character might communicate with Mr. D. H. Ross, Canadian Trade Commissioner, Stock Exchange Buildings, Melbourne, and can obtain the address of the firm named on application to the Department of Trade and Commerce, Ottawa. (Refer File No. A-913).

Lincoln Electric vs. Hydro-Electric

Chief Justice Falconbridge has handed down his decision regarding the recent dispute between the Lincoln Electric Light & Power Company, St. Catharines, and the Hydro-electric Power Commission of St. Catharines in the matter of interference with the company's poles and wires by the Commission. The judgment is worded as follows:

Judgment: I am of opinion that the contention of plaintiff company as to the construction of the last sentence of paragraph 7 is the correct one. I find also, upon the evidence, that the defendant Commission has unreasonably and wrongfully taken down, removed and otherwise disturbed or interfered with the plaintiff's appliances. My judgment is, therefore (1) that the by-law aforesaid confers no right upon the defendant Commission to use the plaintiff company's poles or to string wires thereon for the purpose of distributing and supplying electric current to customers other than the city corporation; (2) there will be a reference to the Master to ascertain the damage plaintiff company has sustained; (3) that the plaintiff company is entitled to an injunction restraining defendant Commission further injuring or interfering with the plaintiff company's poles, plant and system, and (4) costs of this action. Fifteen days' stay.

Annual Meeting Toronto Branch, C.S.C.E.

The Annual Meeting of the Toronto Branch of the Canadian Society of Civil Engineers, was held in the Engineers' Club, Toronto, on Thursday evening, January 21st. The retiring chairman, Mr. A. F. Stewart, presided over a large attendance of the members.

Reports of last year's work, which were presented by the Secretary-Treasurer, Mr. John S. Galbraith, were exceedingly good, showing a marked advance over previous years. Reference was made to the fact that an average attendance of 116 had been obtained at the meetings during the year, and to the successful excursion which was made to the new Welland Canal last October, in which 138 members participated. The reports were duly adopted, after which the election of officers and committees took place.

Mr. J. W. R. Ambrose, chief engineer Toronto Terminal Company, was elected chairman of the Branch for the ensuing year, and Mr. C. H. Fuller was elected secretary. Executive committee—Messrs. J. G. G. Kerry, W. A. Bucke, and Geo. A. McCarthy. Library committee—Messrs. W. Almon Hare, A. L. Mudge, J. R. Cockburn, and A. A. Bowman. The retiring secretary, Mr. Galbraith, was complimented on the enthusiastic work he had performed as secretary during the past year.

The chairman and secretary were instructed to write to each of the members of the Toronto branch now at the battle front. There are about ten in all, of which Col. C. H. Mitchell and Capt. T. C. Irving, Jr., had been responsible for much of the past good work of the society.

The Library Committee reported the following additions to the society's library during the year:—213 volumes of transactions of engineering societies; 7 volumes of the engineering index; 90 volumes of engineering text-books; 17 bound volumes of periodicals; 450 copies of government, provincial, state and municipal reports, pamphlets, etc., and a set of standard topographical maps of Canada.

One of the most interesting meetings of the past year was held on Tuesday, January 19th, in the C. & M. Building of the University. It was addressed by the past president of the society, Mr. M. J. Butler, C.M.G., late deputy minister and chief engineer of the Department of Railways and Canals, Ottawa, and now general manager of the English firm of Armstrong, Whitworth of Canada, Limited. Mr. Butler's address was on "The relations between the engineer, contractor and proprietor," and proved exceedingly interesting to all engineers having to deal with the carrying out of engineering contracts. Something over 350 members attended this meeting, which was followed by a dinner at the Engineers' Club, at which Mr. Butler and Prof. C. H. McLeod, secretary of the society, were guests.

Another Unit For Winnipeg City

During the month of December an additional 5,000 kw. alternator was put into operation at the City of Winnipeg's plant, this bringing the horse-power installed at the city power house up to a total of 39,600. At the present time an additional 5,000 kw. machine is being installed. Also, a second 6,000 kv.a. synchronous condenser was put into service at the city's terminal station. This brings up the synchronous condenser installation to a total capacity of 12,000 kv.a. This installation is perhaps the most interesting of any installation put in in Canada during the past year, and in fact is undoubtedly the first one of its kind to be installed in Canada for the purpose of line regulation only. From the experience gained up to the present there is no doubt that the installation will be a great success both from the operating and engineering point of view and interesting results are expected to be obtained.

In spite of the poor business conditions existing throughout Canada at the present time, the receipts of the City Light and Power Department have shown a very promising increase—the kw.-hours sold during the month being over 20 per cent. in excess of that sold during the same month last year. Considerable work has been done in connection with the grounding of the secondary lines in accordance with the order of the Public Utilities Commission and it is expected that this work will be completed within a reasonable time.

Co-operative Buying

The Canadian Electrical Association has organized a system of co-operative buying of Electrical Supplies by its members. The list of requirements includes meters, carbon and tungsten lamps, transformers, and weatherproof and rubber covered wire. The request for tenders appears in this issue and we are informed that the amount of material required is very large

The co-operative system is beginning to be adopted by some large organizations and the Canadian Electrical Association is following a more or less tried precedent. It is claimed that there are several benefits to be secured by this course, especially in an industry which is so universally and closely bound up with civil life. Not the least of these benefits is the adoption of standard specifications which will be acceptable to all the privately-owned light and power companies in Canada. The manufacturer should breathe a sigh of relief, because nothing is more irritating or unsatisfactory than varying requirements demanded by different purchasers for precisely the same article. This in itself has doubtless largely affected the cost, not only to light and power companies, but also to the ultimate consumer.

It may be objected that the placing of such large orders with individual contracting manufacturers will tend to demoralize trade and create conditions of unequality in which the weaker may suffer. To this the Association will doubtless

reply that in the past history of the economic world the manufacturer has been found amply able to take care of himself, and that it would be disastrous to the permanence of our mutual progress if an honest endeavour to secure the best article at the best price was misunderstood or misinterpreted. The present and future of the electrical industry depend on the universal application and cheapness and reliability of service. The better and less expensive the electrical appliance the wider will be the sowing of electrical activity, the more beneficent its results. No modern industry is subject to a more critical and exacting demand, no other undertaking lives in so white a glare of publicity. It is a matter of service—first, last and all the time,—and to give satisfactory service the best article at the lowest price is necessary.

On the other hand it would appear that the Canadian Electrical Association might have agreed, through its member companies, to standardize their equipment without the further step of establishing what appears to be more or less of a central purchasing department for these companies. It may further be argued that the system of co-operative buying has not become sufficiently established in any line of business to prove its value to the consumer. In theory at least, the placing of large orders with any one firm at a price which is greatly reduced as the result of keen competition, certainly tends, as a natural result, to kill that competition, which, in turn, reacts on itself, finally producing a condition where the competition is less keen and the prices correspondingly greater. That this process of evolution is under way in other lines of trade is the opinion of many manufacturers to-day where this system of co-operative purchasing has been tried. The experiment is an interesting one, however, and will be followed closely by the manufacturers, dealers and central station companies of Canada.

Electrical Equipment of a Dry Dock

Messrs. M. P. and J. T. Davis, general contractors for the Lauzon Dry Dock, Quebec, have awarded to the Canadian General Electric Company, the contract for the apparatus required in the engine room and pump house. It includes three horizontal condensing steam turbo-generators, one of 300 kw., another of 750 kw. and the third of 1,500 kw., with the necessary condensing apparatus and also a 100 kw. vertical engine-driven direct-current generator set.

The main switchboard in the lower house will consist of nine panels and in the pump house there will be three individual motor panels connected in series with the corresponding panels in the power house so that the large motors can be controlled at either place. C. G. E. apparatus is used throughout. An outstanding feature of the main switchboard is the use of Thomson astatic instruments which are not affected by the heavy stray fields so commonly met with on d.c. switchboards of high ampere capacity. Errors due to such stray fields can only be avoided by using properly shielded instruments which have the fields astatically arranged.

For drainage purposes there will be two Mather and Platt axial flow centrifugal pumps each of 6,000 imperial gallons per minute capacity, against 40 ft. head, and driven by a 125 h.p. motor. For the main dock there will be three Mather and Platt axial flow centrifugal pumps, each 42 ins. in size and designed for 63,000 imperial gallons per minute against a head of 25 feet. Each of these pumps will be driven by a 750 h.p. motor. There will also be a Mather and Platt new type centrifugal pump capable of handling 2,600 U. S. gallons per minute against a head of 25 feet for hot well purposes and standard Underwriters steam fire pump of 500 gallons per minute, two end outside packed boiler feed pumps, a Cochrane feed water heater and other appliances.

International Electrotechnical Commission

Report of the Honorary Secretary

Mr. R. E. Crompton, Honorary Secretary of the International Electrotechnical Commission has issued the following interim statement covering the progress of the Commission's operations up to the date of the outbreak of the war:—

As five nations represented on the I. E. C. are now at war, the work of the Commission is temporarily crippled, and as it is necessary to economize expenditure at the Central Office by all possible means, especially in the costly item of printing, we now issue, in lieu of the reports which otherwise would have been in progress, the following short statement of the proposition of affairs at the time that war broke out.

It will be remembered that, at the last plenary meeting of the Commission in Berlin, much of the work of the Special Committees was ratified, and some of it has since been published. Other portions are, for reasons explained later on, not considered sufficiently advanced to take the form of completed reports fit for publication.

Resistance of Copper

Report No. 28 on the International Specification for the Resistance of Copper was issued by the Central Office in March, 1914. As international agreement has been obtained on this fundamental point, we hope that the Tables for copper conductors which are issued in the various countries will ultimately be unified to the benefit of everyone concerned. The settling of an International Standard for the resistance of aluminium has been brought to the notice of the Commission, and further particulars in regard to this will be circulated.

Nomenclature

The list of terms and definitions relating to electrical machinery which have been adopted in the French and English languages are to be published in four languages under the supervision of the National Committees of the countries speaking these languages. The Spanish transcrip was received early in 1914, and was submitted with an explanatory letter to the Spanish-speaking Committees from whom useful criticisms have now been received. The idea of furthering the work of Spanish nomenclature, which is greatly due to the representative of the Spanish-speaking Committees present at the last plenary meeting, especially Senor Diaz Ossa of Chili, is making considerable progress, and it is hoped that a Conference may be arranged later which will do much to encourage unity of action in electrical nomenclature in the Spanish language. In this work the Central Office has to acknowledge the splendid assistance of the Spanish National Committee which has recently been re-organized, and is now in a very strong position, both technically and financially.

Symbols

The first completed portion of the work on symbols was issued by the Central Office as Report No. 27 in January, 1914, and the further proposals in regard to graphical symbols will be issued later.

Prime Movers

The first portion of this work was issued by the Central Office Report No. 28 in July, 1914. Dr. Zoelly Veillon and Mr. Gerald Stoney had brought the new work up to a point sufficient to serve as a basis for discussion at the meeting which had been arranged for September, 1914. These proposals, which deal with the nomenclature of steam-driven electrical plant, will be available for members at the first possible meeting.

Rating of Electrical Machinery

Recommendations of the Special Committee as to the permissible temperature limits, and other portions of the

work of rating which were ratified at the last Plenary Meeting, have been dealt with by the Editing Committee appointed for this purpose. They have been arranged in a logical order so as to make them easy to be consulted by the general public and the work is now practically complete. The question of the temperature of the cooling air or ambient temperature which had been deferred for further consideration has formed the subject of much correspondence, and in addition several unofficial conferences have taken place betweeen representatives of the three large manufacturing nations, the United States of America, Great Britain and Germany. Certain definite proposals which did not in any way interfere with the decisions already arrived at regarding ultimate temperatures published at the time in most of the technical journals, have been put forward with a view of obtaining complete agreement on the value of the reference cooling air temperature. Immediately prior to the war the Central Office had the satisfaction of knowing that the correspondence and conferences on this important matter had not been in vain and that at the meeting of the Special Committee which was to have been held in London in the late autumn of 1914 it was practically certain that a satisfactory solution would have been arrived at with the result that we should have established internationally one basis for the comparison of tenders for electrical machinery. It was intended, and it had been agreed to by German manufacturers (it was certain that the V. D. E. would also agree eventually) that 40 degrees centigrade would be adopted as the reference cooling air temperature together with the limiting figures ratified by the Plenary Meeting and which were issued in the form of a pamphlet to the National Committees in December, 1913. Agreement on this vital point having been practically arrived at, it is hoped that the National Committees who are able now to give the matter attention will endeavour to push forward the other portions of the work relating to this subject that when we are again in the enjoyment of peace, the establishment of the International rating of electrical machinery may be made practicable at the earliest possible date.

In view of the restriction of our work imposed by the war the Central Office is practising every possible economy, but we have to acknowledge with gratitude the generosity of the American Institute of Engineers which will enable the Central Committee to carry on active work, although on a somewhat reduced scale, until the subscriptions for 1915 become due. Since the outbreak of the war subscriptions from certain European countries for the current year have not been received so that the Central Office will doubtless have to face a much curtailed budget for the year 1915. On the other hand the kind and appreciative letters which we have received from several sources encourage us in the confidence that many National Committees will continue to support the Central Office throughout these critical times and so enable us to retain unbroken the continuity of the good work of the I. E. C. for the benefit of electrotechnics and of the electrical industry generally.

McGill Wireless Installation

Owing to the interference by buildings with the Marconi wireless installation erected on the McGill University campus, it has been decided to re-erect the apparatus, one end of the aerial being attached to the top of the power house chimney and the other to the roof of the engineering building. The outfit has been loaned to the University by the Militia Department, the classes being under the direction of Prof. A. Gray and Prof. L. V. King. Messages can be sent about 100 miles, while the receiving area is very much larger. The outfit is of the half kilowatt type. The students will be at the service of the Canadian or Imperial authorities.

Manitoba's Water Powers

The Water Power Branch of the Department of the Interior, J. B. Challies superintendent, has just issued Water Resources Paper No. 7, which is a report on Manitoba water powers prepared under the direction of the superintendent of the Water Power Branch by Messrs. D. C. McLean, S. S. Scovil and J. T. Johnston.

Manitoba is richly endowed with numerous water powers, but, previous to the investigations of the Water Power Branch of the Department of the Interior of Canada, their extent and magnitude have only been approximated. Recognizing the great value of such powers, and with a view to the power requirements of both the present and future, a complete study has already been made of certain power rivers and the investigations will be continued until complete data is available on all the other rivers where power development may be feasible. It is the aim of the government to form a comprehensive scheme looking to the ultimate maximum development of the total head available on any river.

These figures for the Nelson River are much below those given in the "Water Powers of Canada," the 1911 publication of the Commission of Conservation of Canada. The Commission's figures, however, were calculated on the basis of a flow of 118,400 c.f.s.

The great power possibilities of Manitoba are due to the geological and topographical features of the province. The central portion of Manitoba acts as a collecting basin for the waters from an immense drainage area. This vast area extends from the Rocky Mountains practically as far eastward as Lake Superior; it also comprises a great portion of the Northern States and reaches into the northerly lands of Western Canada.

As these waters reach the central portion of the province, a depression occurs between the prairie steppes and the Laurentian plateau, through which an extensive fall is available for power development. Lake Winnipeg forms the reservoir into which is collected practically all the run-off from the above described drainage area. From this lake to Hudson Bay the flow is concentrated in the Nelson River, on which a drop of approximately 700 feet occurs.

From the above it is apparent that the major portion of the powers throughout the basin are concentrated within the lower portion of the drainage area, or more particularly in Manitoba.

The powers are naturally separated into two divisions, viz., those occurring on the rivers draining into Lake Winnipeg, which are situated in the older or southern portion of the province, and secondly, the powers which occur in the northern portion lying in the drainage from Lake Winnipeg. Under these two divisions the estimated powers of the province are tabulated below.

It should be noted that while, on many rivers, possible power concentrations have been investigated and an estimate of the available power is given for various sites, yet as future investigations will show, further power may be available on such rivers. Again, in the case of other rivers, no surveys to determine the extent of concentration available have as yet been made, and in these cases where a record of the flow has been obtained, an estimate is made of the power available per foot head. In many cases the power has been estimated both for the extreme minimum flow and for the lowest monthly mean flow of the highest six months of the year, as obtained from the present record of discharges.

The horse-power has been calculated for a turbine efficiency of 80 per cent., while no estimate has been made as to the power available during short periods of high or peak loads, since this would be impossible without a knowledge of the circumstances for which the power might be desired.

The powers on the Winnipeg River have been considered on a 75 per cent. efficiency basis.

The data for these tables, and also for the more detailed description of the rivers as given in the following chapters, were secured in the field by the Manitoba Hydrographic and Power Surveys, and office compilation in Winnipeg and Ottawa.

The following tabulation of the powers in the province is not intended to fully cover the subject, as many rivers are as yet to be investigated:—

Existing Water-Power Developments

River	Plant	H. P. Developed
Winnipeg	City of Winnipeg	20,800
Winnipeg	Winnipeg Electric Railway Co.	26,500
Little Sask.	Brandon Electric Light Co.	500
Little Sask.	Minnedosa Power Co.	500
Shell	Assessippi	50
Total		48,350

The city of Winnipeg can ultimately supply, with a regulated river, 76,800 24-hour power.

Possible Water-Power Developments, Winnipeg River

Site	Head	24-hr. Power at 75% Efficiency 12,000 sec.-ft.	20,000 sec.-ft.
Slave Falls	26	26,600	44,400
First Site, Seven Sisters	39	11,600	34,800
Second Site, Seven Sisters	37	12,600	37,900
McArthur	18	18,400	30,700
Du Bonnet	56	57,300	95,500
Pine	37	37,900	63,100
Totals		164,400	306,400

Other Possible Developments

The estimated power figures given below refer only to horse-power per foot head, as investigations as to possible concentrations are yet to be made.

River	Site	H.P. on 80% Efficiency, 24 hours. Min. flow.	Period of six highest mos. of yr.
Whitemouth	No. 1	46	180
Whitemouth	No. 2	46	180
Brokenhead	X	0	8
Roseau	X	0	3
Red	St. Andrews	.....	3,270
Pembina	X	.....	......
Souris	X	0.5	4
Shell	X	.....	18
Assiniboine	Curries Landing	653	1,685
Assiniboine	Headingly	36	108
Assiniboine	Millwood	14	64
Little Sask.	No. 1	180	......
Little Sask.	No. 2	203	......
Little Sask.	No. 3	212	......
Little Sask.	No. 4	90	......
Valley	No. 1	34	172
Valley	No. 2	34	172
Valley	No. 3	101	504
Valley	No. 4	94	468
Mossy	No. 1	455	......
Mossy	No. 2	455	......
Waterhen	Meadow Port	6,800	......
Fairford & Dauphin	No. 1	3,630	......
Fairford & Dauphin	No. 2	2,950	......
Fairford & Dauphin	No. 3	12,706	......
Fairford & Dauphin	No. 4	7,260	......
Swan	...	4.5	14
Red Deer	...	13.7	......
Manigotagan	No. 1	90	......
Manigotagan	No. 2	22	......
Manigotagan	No. 3	33	......
Manigotagan	No. 4	82	......
Manigotagan	No. 5	33	......
Manigotagan	No. 6	49	......
Manigotagan	No. 7	92	......
Manigotagan	No. 8	76	......
Manigotagan	No. 9	57	......
Manigotagan	No. 10	74	......
Saskatchewan	Demi Charge	6,808	46,289
Saskatchewan	Red Rock	6,808	46,289
Saskatchewan	Grand Rapids	36,305	246,877

Powers of Nelson River

Site	H.P. based on 80% Efficiency. Estimated Minimum Flow, 50,000 sec. ft.
Whisky Jack Portage	181,150
Ebb and Flow Rapids	77,150
White Mud Rapids	135,860
Bladder Rapids	90,575
Chains of Rock Rapids	158,510
Devil's Rapids	113,220
Grand Rapids	122,530
Birthday Rapids	163,375
First Gull Rapids	77,150
Second Gull Rapids	95,105
Third Gull Rapids	90,575
Fourth Gull Rapids	135,860
First Kettle Rapids	77,150
Second Kettle Rapids	97,370
Third Kettle Rapids	181,150
Upper Long Spruce Rapids	181,150
Upper Long Spruce Rapids	235,495
Upper Limestone Rapids	149,450
Lower Limestone Rapids	185,680
	2,548,505

Improvements in Luminous Arc Lamps

Within the past few months improvements of importance have been made to the pendent luminous arc lamps. Nearly 200,000 of these lamps are now in actual use in hundreds of the principal cities of this country and of the United States. Its popularity is due to the quality, quantity and steadiness of illumination which this lamp gives combined with reliability and low maintenance costs. The improvements which have been effected will make it still more popular.

These lamps are for operation on series direct current circuits of 4 and 6.6 amperes. The 5 ampere luminous arc lamp has recently been designed in order to meet the demand for a lamp having a lower wattage than the 6.6 amperes and giving greater illumination than the 4 ampere type. The improvements in the magnetite electrodes for use with the above lamps consist in increasing the life per trim and increasing the efficiency. The 4 and 5 ampere long life electrodes have a life of 350 and 225 hours respectively or an increase of 75 per cent.

The high efficiency electrodes differ chiefly from the long life electrode in the amount of titanium in its composition, the use of a larger proportion of this element in combination with other materials used yielding the increased light giving properties. The gain in efficiency due to the use of these high efficiency electrodes varies from 25 to 50 per cent.

Another striking development is the skilful adoption of the prismatic refractor to the luminous arc with the object of securing the most effective light distribution for street lighting service. The use of the prismatic refractor permits of a wide spacing of units. As an example of what is accomplished by the use of the high efficiency electrode and prismatic refractor with the luminous arc lamp, it may be stated that the 5 ampere luminous arc lamp so equipped consumes at the terminals only 388 watts giving a m.h.c.p. of 1131 or an energy consumption of only .34 watts per mean hemispherical c.p. this unit developing 2,200 c.p. at an angle of 10 deg. below the horizontal, the most useful angle for street illumination.

In his annual report, Mr. E. O. Champagne, chief boiler inspector for the Montreal Council, blames the railways as the main cause of the smoke nuisance, and says that electrification of the engines on the island is the only real cure. By electrification the danger from locomotives getting out of control of the engineers would be done away with as well as the smoke, spark and cinder nuisance.

Jordan River Power Development

Description of Engineering Features Continued from Jan. 15th issue—Flume, Reservoir, Pipe Lines and Electrical Equipment

By Mr. C. A. Lee, Superintendent

Jordan River Dam (continued)

The deep snow made transportation over the railroad impossible excepting in horse-drawn sleighs. This condition was, of course, foreseen, and 75,000 sacks of cement were stored in the sheds at the dam site before winter set in. This was a sufficient supply to last until the railroad was opened in the spring. Only the necessary camp supplies were transported over the snow.

With the exception of the cableway engine and the derrick engines, all plant used in the construction of the dam was operated by electric motors. A transmission line 7½ miles long, built on the pipe line right-of-way and the flume right-of-way from the power house to the dam site, furnished current at 6600 volts. This voltage was stepped down in a sub-station at the dam site to 2200 volts, the large motors operating at this voltage, and it was further reduced to 220 and 110 volts for the small motors and the lighting circuits.

All cement used in the dam was manufactured in British Columbia. A laboratory was fitted up at the dam and the

Jordan River dam, the completed structure. Water passing over the spillway, March 28, 1914.

usual physical tests were made on all cement as it was received. Tests were also made by an outside laboratory not connected with the work in any way. Each lot of 1,000 sacks was separately sampled for the two sets of tests. No cement was used unless both tests showed favorable results. Boiling or accelerated tests on the cement to be used the following day were made each day in the field laboratory. Compression tests were made on 6-in. cubes of concrete which were cast from the concrete as it was being placed in the buttresses, representing the material actually in the dam. The results of these tests were satisfactory. In building the dam 132,000 sacks of cement were used.

All lumber used in the construction of the dam for form work, scaffolds, camp buildings, etc., was sawn in the company's mill—located at the lower end of the flume. This lumber was transported to the dam site over the flume railroad. The total quantity of lumber used was 1,200,000 ft. B.M.

Main Flume

The main flume follows the east side of the Jordan River valley from the Jordan River dam to the forestry reservoir, a distance of 5.3 miles. The side of the valley is steep for the entire distance and is broken by frequent precipices and deep indentations. As a rule the formation is suitable for the flume foundations, rock or hardpan lying only a foot or so under the surface, but in a few places it was rather difficult to get a secure footing.

The flume is built entirely of timber, and was designed for an ultimate carrying capacity of 175 cubic feet per second. The box is 6 ft. by 6 ft. in section, allowing for a depth of 5 ft. 6 in. of water, and has a grade of 1 ft. in 1,000 ft. As originally built the box was only boarded up to a depth sufficient to carry 75 cu. ft. per sec., and was supported on bents placed 15 ft. centre to centre. During the summer of 1913 the box was completed to its maximum capacity. In order to support the additional weight of water, it was necessary to erect intermediate trestle bents, making the bents 7 ft. 6 in. centre to centre.

The railroad which parallels the flume for its entire length, greatly facilitated the work, as all lumber and other construction materials could be delivered at the points at which they were to be used.

Five gates are provided along the length of the flume. These are set in short boxes formed by dropping the floor of the flume about three feet below grade, and serve to catch all sand and silt which may enter the flume. The gates may also be used to empty the flume quickly in case of emergency.

Nearly 5,000,000 ft. B.M. of lumber was used in the construction of the flume. This was all cut in the company's mill located at the lower end of the flume and adjacent to the forebay reservoir. Logs were procured from splendid timber limits near the mill, and were hauled to the mill over skid roads by steam logging engines. The mill was rated at 20,000 ft. per day, but by replacing the steam power by electric motors the capacity was greatly increased, as much as 45,000 ft. being turned out in a ten-hour day. Although the mill was built primarily to supply the flume lumber, all the lumber used on the job has been sawn in this mill. The total output to date is nearly 8,500,000 ft. B.M., all of which was used for construction work.

The flume has been in continuous service since its completion. There have been several short interruptions due to slides and falling timber. With a flume of this character it is only natural to expect some trouble, but the line is patrolled daily.

Forebay Reservoir

The flume discharges into the forebay reservoir, which is a small artificial lake formed in the comparatively flat saddle between two hills by two earth fill dams built across the valleys immediately to the north and south of the ridge. These dams, or embankments, were built of the material excavated from the higher ground lying between them, thus adding to this extent to the capacity of the reservoir. The capacity is 4,350,000 cubic feet.

The north dam has a length of 560 feet on the crest and contains 24,290 cubic yards of material. The south dam is 700 feet long and has a volume of 26,560 cubic yards. The slopes of both embankments are 2½ to 1 on the water side and 2 to 1 on the lower side. The maximum height of both dams is 35 feet.

Two 44-in. diam. rivetted steel pipes pass through the base of the south dam at the head of the pipe lines. From the core wall to the upper edge of the dam these pipes are embedded in concrete, but from the core wall to the lower

toe they are in open culvert with a common centre wall and reinforced roof, thus insuring perfect drainage and allowing inspection. A concrete intake structure is built at the upper end of the pipes, and the control of water is obtained by means of two 54-in. diam. roller-bearing sluice gates, behind suitable trash racks. The gates are controlled from the top of a structural steel gate tower, which is connected with the crest of the dam by a light foot bridge.

An emergency spillway is built in the solid ground at the east end of the north dam, and any surplus water is here returned to the river, which flows in the valley about 400 ft. below the forebay level. The crest of the spillway is 5 ft. below the dam crests.

The function of the forebay is to increase the peak load capacity of the power house by providing storage immediately at the head of the pipe line, and also to furnish a reserve supply of water sufficient to operate the generating machinery for a few hours in case of accident to the flume.

Pipe Lines

The pressure pipe lines from the forebay to the power house are 9,290 feet long. They follow the general slope of the hill, and are laid in shallow trenches with the earth backfilled to form a cover over the pipe. There are numerous vertical bends of a few degrees each, as the slope of the hill side is not uniform, but there are no sumps or crests in any of the pipes. The lines are practically straight from the forebay to the power house, with only a slight horizontal bend near each end. In excavating the trenches for the pipes all surface soil was removed. The pipes are well supported on hardpan or gravel for their entire length. The space between the bottom of the pipe and the trench is tightly packed with small rocks and gravel. This serves to give uniform support over the entire length of the pipe and also forms a drain for seepage water. Concrete deflecting walls, built at intervals along the pipe, turn this water out of the trench and into natural drains along the hill.

No. 1 pipe is a lapwelded steel pipe varying in thickness from 5-16 in. at the wye to 9-16 in. at the power house. The joints between the sections are spherical "bump joints," with double or single rows of rivets, depending on the thickness of the steel. For 2,200 feet above the power house the pipe is banded with 1-in. steel bands having malleable cast iron shoes. This banding was considered necessary on account of possible severe rams in the pipe caused by quick governing.

No. 2 pipe is a heavy rivetted pipe made up of parallel outside and inside courses, the thickness varying from ½ in. at the wye to 1 in. at the power house. The longitudinal joints are provided with double cover plates, making a joint of about 78 per cent. efficiency. Although this pipe is ¼-in. greater in diameter than No. 1 pipe, the results obtained are not as good. The very rough interior surface of the pipe which results from the parallel courses and the numerous rivet heads, increases the friction in the pipe so that there is a considerable loss of head when the unit is loaded. The friction loss, or loss of head, is nearly 15 per cent. greater for No. 2 pipe than for No. 1.

Pipes No. 1 and 2 are each equipped with six air valves, about equally spaced along the lines. Each pipe has also three manhole openings, one located at the lower end, one at the wye pipe, and one half-way between these two. There is also a manhole in the 44-in. pipe just below the forebay. Pipeline No. 3 is provided with seven air valves equally spaced along the line, and the manhole openings are located 1,000 feet apart along the entire length of the pipe. This generous use of manholes was of great assistance in the erection of the pipe, the extra cost being more than compensated for by the time gained and the wages saved.

Connected with the installation of No. 3 pipe there are some experiences which may prove of interest. The erection of this pipe was started late in the summer of 1913, and the field work was finished early in January, 1914. On filling the pipe for the first time several leaks developed in the circumferential welded joints of the heavier pipes near the power house when the pressure was only a small fraction of the static head to which the pipes would be subjected when filled to the top. These leaks were repaired by rivetting heavy butt-straps around the pipe at the faulty welds, but on account of the possibility of other leaks developing and damaging the power house or the other pipe lines, it was decided not to fill No. 3 pipe until it had been tested and made safe against further failures.

It was planned to test the pipe in comparatively short sections, so that in case of failure the amount of water in the section under test would not be sufficient to do any damage. To make these tests a bulkhead was designed to fit in the pipe at the upper end of the section under test and to confine the water between that point and closed gates at the lower end of the pipe.

The bulkhead was made up of a dished steel casting about 2½ in. less in diameter than the internal diameter of the pipe. The circumference of this casting formed the base of a packing gland built up of steel rings which confined the packing. The packing consisted of two rings of 1 in. square hard steam packing, one on either side of a ring of rubber packing 1 in. thick and 2-in. wide. The back steel ring of the gland was provided with sixteen forged steel dogs which held the ring from moving up the pipe, the ends

Bulkhead used in making tests on No. 3 pipe.

of the dogs resting against the end of the next section of pipe at a rivetted joint. The pressure of the water against the bulkhead compressed the packing by forcing the bulkhead or disc into the back ring of the gland, which, in turn, was held securely in place by the dogs, thus making a watertight joint. The whole contrivance was mounted on rollers to enable it to be moved along the pipe.

The pipe line was cut at the upper end of the welded portion of the pipe, and the bulkhead was lowered (by means of a light wire rope) to the upper end of the section to be tested first. Some trouble was experienced at first in setting up the bulkhead in the pipe, but after several unsuccessful attempts the pipe crew learned to overcome their difficulties and were able to make a tight joint.

The pipe was filled up to the bulkhead through a by-pass from one of the old lines, and the pressure was raised to the required test pressure by means of a large hand operated boiler test pump. The bulkhead was provided with an air valve to exhaust all air from the pipe and make sure that the space was entirely filled with water. A pressure gauge was attached to the pipe and in each test the pressure was raised by means of the pump at 35 per cent. in excess of the pressure due to the static head, this pressure being recorded at the lower end of the section under test. Before making

the excess pressure test, each section was tested under static head by hammering along the welds with 3-lb. hammers.

So far as the writer has been able to learn, this is the first time a large high pressure pipe line has been tested in the field after erection. The results obtained at Jordan River would indicate the practicability of such a test, and it must be admitted that such a test is of great value in proving the pipe, not under shop conditions, but under actual working conditions. These tests suggest the use of a bulkhead, similar to the one used at Jordan River, in connection with the erection of almost any long pressure pipe line. By the use of such a bulkhead the pipe could be tested from the bottom as the work proceeded. It could be kept filled with water and the trench could be backfilled at once, thus avoiding the usual temperature stresses set up in such a pipe line.

The Pelton Water Wheel Company, who were the contractors for the pipe line, designed the bulkhead and made the tests on the pipe under the direction of the Vancouver Island Power Company's engineers.

POWER HOUSE AND MACHINERY

The power house is located near the beach and about 2,500 ft. east of the mouth of the river. The pressure pipe lines enter the rear of the building and the water from the wheels is discharged at the front where it enters a short tailrace channel which empties into a tidal slough joining the river near its mouth.

The original power house building, completed in 1911, is a concrete structure having a ground area 91 feet 6 ins. long by 47 feet wide. In this building space was provided for two generating units of 4,000 kw. capacity each, two 100 kw. exciter units, two banks of transformers, and other auxiliary electrical apparatus to complete the equipment. No. 1 generating unit was put in operation in the latter part of 1911, and the following year No. 2 unit was installed.

Before starting on the construction of this building test pits were sunk to determine the nature of the underlying material. Test piles were also driven and were loaded and found to successfully support over five tons per square foot. The pits uncovered a stratum of hard sandy clay about 18 to 20 feet below the ground surface. Bedrock was known to lie about 50 to 75 feet below the surface, but it was not considered necessary to go this deep to be assured of a satisfactory foundation. The building and machinery foundations were designed to be placed on the hard clay stratum about 18 feet below the surface, with a maximum load of not over four tons per square foot.

An Unstable Sub-surface

When the construction was nearly finished it was noted that the building and machinery foundations appeared to be sinking, and this fact was verified by taking levels. By means of a small well drilling outfit several test holes were sunk to bedrock, and it was then found that the hard sand and clay stratum extended only some sixteen feet below the base of the foundations, where it merged into coarse beach gravel and sand extending about ten feet further, below which, at a depth of about 25 feet beneath the foundation, a 20-foot layer of soft mud and peat existed which yielded to the pressure of the stratum above with its super-imposed load. This bed of peat and clay lay directly over the soft sand-stone bedrock. These test holes proved very conclusively that the flat on which the power house was built was formed by a series of slides off the steep hill behind. It is of interest to note that in sinking the test drill holes and the foundation piles, the drill passed through fir logs about six feet through and 40 feet underground, which appeared, from the chips and borings brought up in the sand pump, to be in a perfect state of preservation. Later on some pieces of Indian basket were pumped up from a depth of about twenty five feet. The great age of the fir logs and the basket may be estimated from the fact that trees growing on the surface of the ground could not be less than 400 or 500 years old.

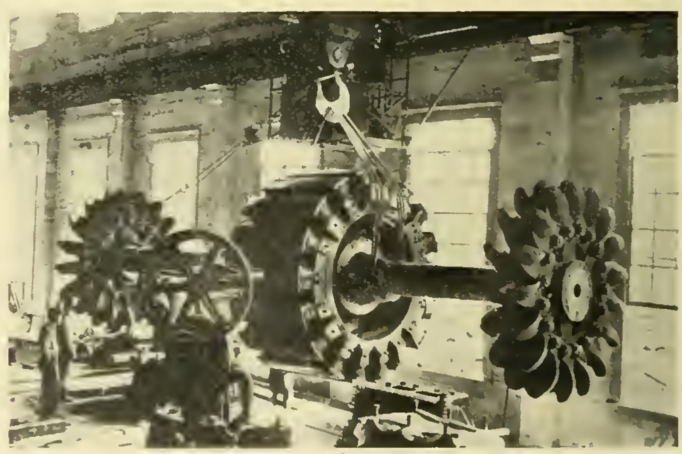
When the subsurface formation was determined, steps were at once taken to reinforce the machinery foundations. A trench was excavated around these foundations and they were cut entirely free from the building. By means of a well drilling outfit, twenty-two 12-in. standard pipe casings were sunk around the foundations to bedrock, and these casings were filled with concrete. Holes were cut through the foundations near the bottom, and large I-beams were inserted, resting on the tops of the concrete piles. These beams were concreted into the foundations and the tops of the piles were incased in concrete, making a solid mass above the tops of the piles and assuring a rigid support.

No. 1 pipe line was cut about three-fourths of the way round in two places immediately behind the power house. These cuts were banded with heavy cast iron muffs which were caulked with lead wool, and in this way flexible joints were provided so that no strain could be thrown on to the pipe by any movement of the building or the machinery foundations.

A pile foundation similar to that for No. 1 unit was driven for supporting No. 2 unit, but in this case the concrete foundation was built directly over the piles and not supported on I-beams. No piles were put down to support the building as this was not considered necessary, since it was cut entirely free from the foundations of the machines. Such slight settlement of the building as has occurred has not been serious. The walls are cracked in a few places, but aside from this no damage has been done.

The Extension a Separate Building

The construction of the addition to the power house was started in the spring of 1913, but on account of unavoidable delays which necessitated shutting down all construction work for about eight months, the work was not finished until September, 1914. The new building is not altogether an extension to the old one, but was constructed as an entirely separate building, not being tied to the old one in any way. It covers about double the area of the old building. The main part of the new building is a continuation of the old one and is 120 feet long and 47 feet wide, forming the generator room. Behind this, and also extending behind the old building for over half its length, is a large room 130 feet long by 27 feet wide, which forms the high tension switching room.



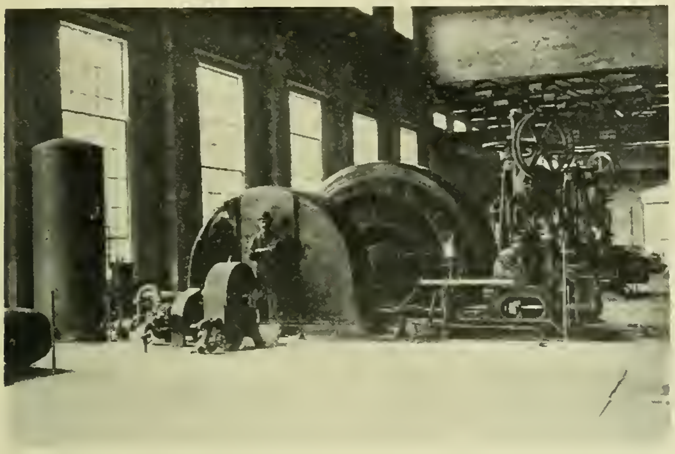
Assembled rotating parts No. 3 unit.—Weight 64 tons.

The floor of the old building is at elevation 107.5 or $7\frac{1}{2}$ ft. above high tide. This was considered too low as there might be a possible combination of high tide and strong wind which would back the water up into the wheel pits and put the plant temporarily out of commission. The floor of the new building was therefore built 5 ft. higher than this

with a corresponding difference in the elevation of the wheel pits.

The whole weight of the building and machinery is supported on concrete piles resting on bedrock. These piles are similar to those supporting No. 1 and No. 2 units in the old power house. They were cast in 12-in. diameter standard pipe casings which were driven by a well drill and vary in length from 45 to 75 ft., the average length being 56½ ft. The total number of piles under the building and machinery foundations is 102, and these are so placed as to equalize the load as nearly as possible, the average load per mile being 28 tons.

The piles were cut off below the basement floor level which is at elevation 102.5. Those under the walls of the building are capped by a heavy reinforced concrete beam



Generator, governors, oil pump and gate valves—No. 3 unit.

which supports the walls of the building and also the edges of the basement floor. The floor of the basement is a reinforced concrete slab 8 ins. thick which is continuous over the entire area of the basement, securely tieing together the tops of all the foundation piles and thus assuring a very solid and rigid structure. Between the piles all soft surface soil was excavated down to gravel stratum and the excavation was back-filled to the bottom of the floor slab with gravel and sand, tamped in to form an unyielding support for the floor above. Over the groups of piles which support the machinery the floor thickness was increased to 2 feet and reinforced with 1-in. square rods on 12-in. centres both ways. This heavy slab extends for nearly the whole length of the generator room and supports the concrete foundations for the generators and exciters. Reinforcement rods are embedded for 6 feet into the tops of all the piles and are bent over to tie into the concrete resting on the piles.

In order to limit the loading on the foundation piles, the building was constructed as light as is consistent with good design. The walls are 12 ins. thick up to the level of the main floor, and above that they are 8 ins. thick, but stiffened by pilasters placed 13 ft. 6 ins. centre to centre. The pilasters are heavily reinforced with ⅞-in. rods and the walls are reinforced with ⅜-in. rods on 18-in. centres both ways. The roof is a reinforced concrete slab 3½ ins. thick and supported on steel roof trusses and I-beam purlines. The front crane girder is supported on the front wall pilasters, which extend 12 ins. inside the wall, but the back girder rests on 15-in. I-beam columns which are supported on concrete columns below the main floor. These I-beam columns are continued above the crane girder step and support one end of the roof trusses along the peak of the roof.

The new part of the power house building is not joined to the old part in any way, and in case of any further settlement of the old building, the new part will not be affected. Wherever the walls, floors or roof of the new building come in contact with the old work a slip joint is provided. This joint was made by pointing the old concrete along the surfaces of contact with several thick coats of asphaltum compound, which is commonly used for filling expansion joints in concrete work. This compound does not become soft and run out of the joints at any ordinary temperature.

Space for Future Units

Space is provided in the new building for two generating units, with exciters and other auxiliary electrical apparatus, but only one unit is installed at the present time. The new high tension switch room is designed to accommodate all of the high-tension switches for both the old and the new installations, and space is also provided in this room for two sets of inside type lightning arresters.

No. 1 and No. 2 units in the old building are identical in size and design. Each of these has a 4,000 kw., 2,200 volt, 3-phase, 60-cycle Allis-Chalmers-Bullock generator driven at 400 r.p.m. by a single Doble tangential water wheel of 6,000 h.p. which is mounted on one end of the shaft and overhangs the bearing at that end of the unit. The shaft is a hollow nickel steel forging having a diameter of 14 ins. in the bearings, which are 40 ins. long. These bearings are peculiar in that they have no top shell. The weight of the revolving parts is sufficient to overcome any tendency of the shaft to lift or roll out of the bottom shell, and the whole upper half of the shaft being exposed, a great quantity of oil is spread over it by the oil rings and efficient lubrication is assured.

Water is conveyed from the terminal end of the pressure pipe through a cast steel flanged taper pipe which is bolted to the flanged end of the pipe. This taper piece decreases in diameter from 30 ins. to 24 ins. at the outlet end, where it is bolted to a hand operated, 24-in. single disc, steel body, rising stem gate valve which is provided with a by-pass. The steel nozzle casting is bolted to this valve. The jet of water is projected onto the wheel through a Doble needle regulating nozzle and the governing is done by a type Q Lombard governor, operating the needle gear by means of an oil pressure cylinder. Surges or rams in the pipe line caused by the quick closing of the main nozzle are prevented by the Doble relief nozzle. This nozzle is similar to the main nozzle, but is located below it and the stream does not hit the buckets on the wheel, but is discharged freely down the tail race. This relief nozzle is operated by the governor through links connected to a dash-pot or differential cataract on the relief needle stem. The gradual closing of the main nozzle does not operate the relief, but in case of quick closing the cataract comes into operation and the relief opens as rapidly as the main nozzle closes. Heavy coil springs bring about the gradual closing of the relief nozzle, and the time of closing can be regulated by adjusting the cataract by-pass valves. Oil pressure for the operation of the governor is supplied by a motor-driven oil pump which automatically maintains the pressure in the supply tank.

No. 3 Unit

No. 3 unit was put into operation in October, 1914. This unit is an 8,000 kw., 2,200 volt, 60-cycle, 3-phase, Canadian General Electric generator driven at 400 r.p.m. by two Doble tangential water wheels, one mounted on each end of the shaft and overhanging the bearings. The water wheels are rated at 13,000 h.p. The shaft is a hollow nickel steel forging and is 16 ins. in diameter in the bearings, which are 60 ins. long. These bearings are of the single shell type similar to those on No. 1 and No. 2 units.

The two wheels on this unit are supplied with water through a flanged cast steel wye which is bolted to the terminal end of the pressure pipe immediately behind the unit foundation. The entrance connection of the wye is 48 ins. in diameter and the branches are 34 ins. To these branches are bolted cast steel taper pipes, reducing to 24 ins., and to these are bolted the 24-in. single disc, steel body gate valves.

These gate valves are operated by small reversible water wheels which are mounted on brackets on the yokes of the valves. The water motors operate the bronze nut on the rising stem of the valve through a system of spur and bevel gearing, and provide a dependable means for opening or closing the valves. Water is supplied to the wheels through short pipes connected to the hood of the valve, and an automatic device is provided which prevents over-running. The cast steel nozzle bodied with main and relief nozzles, are bolted directly to the gate valves.

Each wheel is provided with an entirely separate direct motion, oil operated, relay type governor, the piston of the governor motor cylinder being mounted directly on the extended needle stem of the main nozzle, and from this stem the auxiliary or relief nozzle is operated by double levers connected to the cataract on the stem of the auxiliary needle. This direct application of the motive power of the governor to the controlling means of the water wheel, without any intermediate connections, is a great improvement over the old system of applying the power through a system of links, with their inherent lost motion and backlash. These governors have given exceptionally good regulation without causing any appreciable surges in the long pipe line. In testing the governors the unit was run with water on both wheels and both governors in gear, with no load on the generator.

Connected with the governors is a special hand control consisting of a separate cylinder, the piston rod of which is connected to the main needle levers, and a hand oil pump for operating this cylinder. When the governor is in gear the hand control is thrown out by opening a by-pass and allowing the oil in the cylinder to flow freely past the piston.

Oil pressure for the operation of the two governors is provided by a water motor driven gear type pump with a welded steel oil pressure accumulator tank. The pump motor is controlled by a float in a chamber connected with the accumulator tank.

A Separate Exciter

A separate exciter unit is provided for each main generator unit. No. 1 and No. 2 exciters are 100 kw. 125-volt direct-current generators on the same shaft with a 100 h.p. water wheel and a 150 h.p., 2,200-volt induction motor. No. 3 exciter is a 200 kw. generator direct connected to a 200 h.p. water wheel and a 300 h.p., 2,200 volt induction motor. No governors are provided for the exciters, the speed being held constant by the induction motors. Water is supplied to the exciter wheels from a header connected to all three main pressure pipes. An arrangement of valves permits any exciter unit to be run off any main pressure pipe.

The Transformers

The transformer equipment consists of two banks of 1,450 kw. transformers, with one spare, and one bank of 3,000 kw. transformers; all of the oil insulated, water-cooled type. They step the voltage up from 2,200 to 60,000 volts, at which pressure the current is transmitted to Victoria.

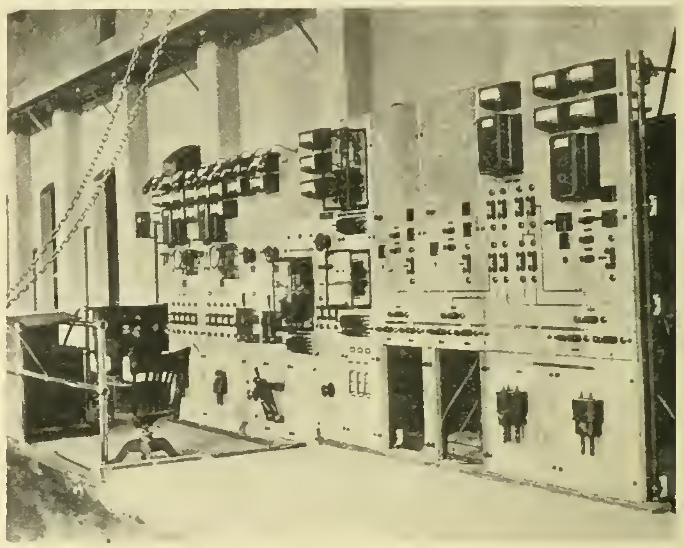
The cables from the generators are carried in tile ducts embedded in the concrete floor of the building, to the generator switches, and thence to the bus room located in the basement of the west end of the new building. Directly above the bus structure, on the main floor, are located the 2,200-volt, old break, automatic switches. After passing through these switches the current at 2,200 volts is carried along the back wall of the building behind the transformers, and from here is tapped to the primary side of the transformers. All of the 2,200 volt conductors are made up of ¼-in. by 4-in. copper bars, the number of bars used varying in proportion to the current to be carried.

Current at 60,000 volts is conducted from the transformers through the back wall of the generator room in porcelain wall bushings and into the high tension switch room. The high-tension buses are supported on insulators on the back wall of the room and the oil break switches are in a line down the centre of the room, directly under the disconnecting switches, which are mounted on a structural steel frame. All high-tension conductors are 1-in. copper tubing. Two 60,000-volt lines leave the building through large wall bushings, and lead to a steel distributing tower a short distance in the rear of the power house.

All lighting and control wiring in the power house is concealed in conduit pipe embedded in the concrete floors and walls.

Transmission Line

The transmission line from the Jordan River to the Victoria sub-station is 37 miles long. For about fifteen miles from the power house it follows the shore line through some very rough and heavily timbered country, but at that point it strikes inland for the remaining distance. The right-of-way is



Switchboard—showing old and new boards.

cleared on both sides of the line to a sufficient width to guard against the breaking of the line by falling trees.

The poles are of cedar cut from the forest adjacent to the line. They have a minimum diameter of 9 ins. at the top and are from 50 to 60 ft. high. The cross-arms are of galvanized steel 9 ft. long, and are made up of two 1¾-in. by 1¾-in. angles, with 1¼-in. angle diagonal braces to the pole. This provides for two 3-phase circuits, one carried on either side of the pole. The spacing of the poles varies from 300 to 400 ft. but there are several spans across gulleys which are much longer.

The conductor is aluminium cable made up of seven strands of No. 8 wire. It is supported on two-piece brown glazed porcelain suspension type insulators. At all angles where the line is drawn towards the pole it is dead-ended, using two insulators with the conductor taken across in a suspended loop.

At present only one circuit is carried on the poles, but it is intended to string the second circuit in the near future.

Organization

The work, from the first pioneering to the final completion of the installation of the first 4,000 kw. unit in the spring of 1912, was under the direction of Wynn Meredith, one of the firm of Sanderson and Porter. The preliminary surveys were under the immediate charge of A. B. Carey and E. E. Carpenter was in immediate charge of all construction.

Since the completion of the initial development, all work has been done under the direction of G. R. G. Conway, M. Can. Soc. C.E., chief engineer of the company, with G. M. Tripp as engineering superintendent in Victoria. The writer has had charge of construction since September, 1912

International Niagara Power Question

Necessity for Constant Watchfulness Lest Conditions Unfavorable to Canada Become Established—We Shall Soon Need Our Full Share

By Mr. Arthur V. White*

A complex situation exists along the Niagara River, more particularly in the vicinity of the Falls. Since the ratification of the Boundary Waters Treaty, a number of Bills relating to hydro-electric development on the Niagara River, have been presented to the United States Congress.

Smith Bill—Cline Bill

Two such Bills have been under special consideration by the Committee on Foreign Affairs. One of these was introduced by Representative Chas. B. Smith, of the State of New York, and the other by Representative Cyrus Cline, of Indiana, who is also Chairman of the Sub-Committee on Niagara legislation.

Of the various Bills introduced, the provisions of the two just mentioned are the more important, and if enacted into law, without being modified, will be of serious import to Canada. Such Bills have one very important aspect, namely, that if they are enacted into law they are of force in the United States, even though the Treaty relating to Boundary Waters should lapse.

There are two features which affect Canada more immediately and which are common both to the Smith Bill and the Cline Bill. These are: **the exportation of electricity from Canada to the United States**; and, second, **the quantity of water which will be permitted to be diverted from the Niagara River for power purposes.**

During 1914, it has been necessary, on several occasions, to prepare Memoranda dealing with these subjects, and some of the statements appearing in such Memoranda are here made use of.

Doctrine of Equal Benefits

Before proceeding with our brief survey there are one or two matters related to the legislation now pending at Washington, which should be borne in mind. One of these is what we may term the **Doctrine of Equal Benefits.**

When the International Waterways Commission has deliberated on behalf of Canada and the United States, upon such matters, the opinion has repeatedly been expressed, that the division of Boundary Waters and the benefits therefrom, should be based upon the doctrine of equality. It was represented that neither Canada nor the United States desired to be forced into circumstances which made for inequality of benefits without receiving adequate **quid pro quo.** Thus, with respect to electrical energy, one fundamental subject laid down for consideration by the Commission was:

> "The transmission of electric energy generated in Canada, to the United States, and vice versa."

The present International Joint Commission, in some of its opinions, has been pronounced in giving expression to this same principle, or doctrine, of equal rights and benefits.

A Question of Jurisdiction

One other point involves the question of extent of the jurisdiction of the International Joint Commission, with respect to certain diversions of water above the Falls. Both the Smith and the Cline Bill contain provisions which imply a raising of this question.

A careful reading of the Boundary Waters Treaty will show that the International Joint Commission have jurisdiction over the Lower Niagara River. It would, however, appear that the authors of the Bills above referred to, as well as certain other persons, assume that the Commission are without jurisdiction for certain diversions above the Falls.

The Subject of Plant Efficiency

This subject of jurisdiction may involve the right to utilize the additional 100 feet of head existent in the Lower Niagara River. And in this connection both the Smith Bill and the Cline Bill contain provisions relating to efficiency of plants; and to the possible enforced abandonment, at the order of the Secretary of War, of the present power developments at Niagara Falls on the United States side of the boundary, and the replacement of these plants by others utilizing the water under the combined head obtainable from the Falls, and the rapids of the lower River. This is an important subject, because, for one thing, companies in the United States—notably the Niagara Gorge Railway Company—appear to be seeking an opportunity to make diversions from the lower Niagara River. It would be profitable to consider to what extent either of the Bills would afford opportunity for companies to secure such rights of diversion and, in this connection, the remarks of the late Secretary of War, before the Committee on Foreign Affairs in February, 1913, are notable.

Expiration of Burton Act

Another point to be remembered, is that the Burton Act, which for years restricted both the diversion of water and the importation of electricity into the United States, expired about a year ago. The Burton Act provided for the granting of permits for diversion on the United States side, of 15,600 cubic feet of water per second. The Boundary Waters Treaty provides for an allotment to the United States of 20,000 cubic feet of water per second. Permits for the difference, 4,400 second-feet, have not yet been granted. This surplus water is coveted by the State of New York; by the existing power companies; and by other interests. A knowledge of this fact will throw light on certain phases of the legislation proposed in the Bills which are here a subject of comment.

The United States Fears that Canadian Markets May Absorb Electricity

An object avowedly sought to be attained by some of these measures, is **the importation into the United States of increased quantities of electrical energy generated in Canada.** It is abundantly evident that the motive prompting the **early** passing of such legislation is the fear that the longer the delay that occurs in actually receiving electrical energy from Canada, the less will be the amount that may be so received; because Canada, owing to her growing manufactures and demands, is rapidly absorbing the surplus energy which is coveted chiefly for the State of New York.

Consider some confirmatory testimony upon this matter: Lieutenant-Colonel J. C. Sanford, reporting on January 6th, 1913, upon the subject of Niagara power, to the Chief of Engineers, United States Army, states:

> "There is no question but that Niagara power will soon be utilized to the fullest extent allowed by governmental restrictions. If advantage of the power, generated in Canada, cannot be had on the American side, manufacturers will be attracted to Canada by this cheap power, and the industries of this country will suffer accordingly. The effect of present restrictions on the importation of power is becoming noticeable. . . .

* Before the annual meeting of the Commission of Conservation.

Manufacturers at present contracting for additional Niagara power must locate and are locating in Canada. It therefore seems advisable to permit immediately the importation of Niagara power to the fullest extent permissible under the law, and, other things being equal, to grant permission for its importation to the company or companies which will make the earliest use of such power."

The former Secretary of War, Honourable H. L. Stimson, before the Committee on Foreign Affairs, recently stated that:

"The investigation which has been made by the Engineers indicates that Canada, if we do not take it, will use the entire amount that the Treaty permits in a very brief time, so that whatever effect any restrictions on importation would have, would not protect the falls for more than a very brief period, and it would result in giving to Canada, very possibly, a large number of industries which otherwise would be established on this side of the falls."

When Representative Chas. B. Smith was speaking on behalf of his Bill, he submitted, before the Committee on Foreign Affairs, a letter from a leading citizen of Buffalo, in which it is stated:

"Every restriction on the importation of Canadian power should be at once removed. Electrical power is a **raw material and should be free.**"

The Sub-Committee on Niagara Falls power, appointed by the Committee on Foreign Affairs, in their report on one of the Cline Bills, state that it had been urged for their attention:

"That the Canadian companies were rapidly increasing their sales and would very soon take the full amount of water they were entitled to and United States ought to get what power it was able to **now.**"

and they add:

"If the advancement in the development of power on the Canadian side increases for another year or so—and it is not apparent to the Committee that it will not, then the Committee concluded that it was proper to take as large an amount as it could get for consumption in the villages, cities, factories and homes along our border."

Representative Chas. B .Smith, of the State of New York, in conversation, stated to me, that he favored no restriction on the importation of electricity, because if it was good for United States to have this commodity he thought it was advisable to get as much as possible, and permit it to come into the country without any restriction. This view of Mr. Smith is amply reflected in certain bills of his which provide for no restriction.

Market in United States for Electricity

In the State of New York there is a ready market for additional electrical energy. The **Opinion,** delivered on February 12th, 1914, by the Public Service Commission of the State of New York, states:

"That there is a large shortage of electric power in Western New York with a strong demand for greater supply which is not being met by existing companies."

Again the **Opinion** states:

"We are using all the power made on the New York side, and all that has been brought from Canada, and the demand for more power in Western New York is insistent and is being urged with great force."

It is also stated that Niagara Falls power produced in the United States is so far from supplying the needs of portions of the State of New York, that if the importation of power were prohibited it "would plainly amount to a great public calamity."

It is most definitely affirmed that there is present demand for additional electrical energy on the United States side of the boundary, and, in consequence of this market, strenuous efforts, especially during the last two years, have been made to secure as large an amount of power as possible from the Canadian side. By so doing vested interests may be created, and thus make it difficult, if not impossible, for Canada ever to use this power without the risk of serious international differences.

International Complications Possible

Canada, naturally, desires to avoid contributing to any circumstances which might have within them the possibility, later, of creating difficulty with any foreign nation, and especially any difficulty with the Republic on her southern border.

The chief danger lies, not with the peoples themselves, but with the aggressiveness of powerful United States' commercial interests whenever they fear their assets are jeopardized.

In the **Opinion** just rendered by the Public Service Commission of New York, the Commissioners state:

"We have nothing before us but the suggestion that the Dominion of Canada may at some future time forbid this exportation. This Commission must assume that international relations affecting so important a subject as the means of continuing great industries which have grown up in reliance upon the use of this imported power, and as well the interests of the Canadian producing companies themselves have become fixed and subject only to such changes as will fully protect the great commercial and industrial interests and rights now served by this power brought from Canada. The time has long since passed when governments proceed ruthlessly from pure national rashness or anger to destroy the settled accepted commercial relations and formally vested rights of persons and corporations."

Elsewhere the Commissioners also state that:

"In deciding these cases the Commission must assume that relations between Canada and the United States affecting the means of continuing great industries which have grown up in reliance upon the use of electric power imported from Canada, and as well the interests of the Canadian electric producing companies themselves, have become fixed and subject only to such changes as will protect the great commercial and industrial interests and rights now served by electric power brought from Canada; and particularly so as in these cases it appears that the percentage of export power to plant capacity is the same as has been and is allowed by Canada to other exporting electrical companies."

The Burton Act empowered the issuance of **revocable permits** for the transmission of additional electric power from Canada into the United States, and it may further be emphasized that the **Fluid Exportation Act** provides that licenses for the export of power from Canada are also revocable. What then is the real import of this remarkable statement by the Public Service Commission of the State of New York? It, in effect, proclaims that we, in New

York, need not be concerned about permits and licenses, revocable or otherwise; it states plainly that if we can get this electric energy from Canada into the United States, and have it distributed so that our citizens and industries become dependent upon it, then Canada could not hope to alter these conditions—for, in the words of the Commissioners, the conditions in the State would "have become fixed, and subject only to such changes as will protect the great commercial and industrial interests and rights now served by electric power brought from Canada—that is to say—as will protect "the great commercial and industrial interests and rights" in the United States.

Some years ago, when the relations of the United States with Canada were under discussion before the "Select Committee on Relations with Canada, of the United States Senate," Mr. Joseph Nimmo, Jr., addressed the Committee with respect to the possibility of Canada dealing with her transportation facilities in a manner such as, adversely, to affect interests in the United States using Canadian transportation, and stated that:

> "In the entire range of our Canadian relationship, from Halifax to Vancouver, the United States holds an over-powering advantage over Canada, and at every point. The suspension of the transit trade would be of comparatively small disadvantage to the United States, whereas it would be utterly disastrous to Canada . . . . . . It is high time for the people of this country to appreciate the fact that their National Government holds a preponderance of commercial power on this continent as absolute as the preponderance of its military power, and to demand that those who are charged with the affairs of government shall adopt such measures as shall prevent any interference by a foreign power with the course of the development of our domestic or foreign commerce."

Canada, in connection with the exportation of electricity, certainly does not desire to assist in the creating of any circumstances which would even tend to invite a possible carrying out of any such policy as is suggested by the language in the Opinion delivered by the Public Commission of the State of New York, or in the address, just quoted, as delivered at Washington before the Select Senate Committee on Relations with Canada.

When the diverse and powerful financial interests which are represented in these great Niagara developments are scrutinized, it will demonstrate the absolute necessity that we possess such a knowledge of the facts as will enable wise counsel respecting the adoption of administrative policy respecting the hydro-electric power appertaining to Niagara. To these matters the Commission of Conservation have devoted much study.

Other Water Problems Suggested

Questions connected with other waters such as with the St. John River in New Brunswick; Navigation and Power on the St. Lawrence; Transportation on the Great Lakes, and via the proposed Georgian Bay Canal; questions relating to diversion and power development on the St. Mary River, Lake Superior; or on the Fraser and the Columbia Rivers in British Columbia; Diversions for Irrigation of the St. Mary and Milk Rivers in Alberta; Power or other problems involving the Pend d'Oreille; the Kootenay; Okanagan, Skagit and other rivers and lakes in British Columbia are indicative of the many and diverse subjects in which this Commission is interested, and frequently especially interested on account of the International complications which exist, or which may arise in connection with the use, or abuse, of such waters.

High Capacity Outdoor Station Equipment

By Mr. H. W. Young

The problem of furnishing electricity supply to relatively small consumers or communities has been well met by the standard medium-capacity sub-station units, so designed that an abnormal flow of current across the "straight line" discharge gaps is interrupted by a carbon-tetrachloride fuse. With this arrangement a disturbance is localized and prevented from spreading to the main distributing system.

As the carbon-tetrachloride fuse also protects the transformers against short circuits or overloads, an abnormal discharge across the horn gaps may result in a service interruption. In actual central station practice, experience shows, however, that such interruptions, due to lightning, are relatively infrequent as compared to the total hours of service While an occasional service interruption may occur, it is obviously preferable to use the low-cost outdoor sub-station units where the income to be derived is relatively small. These medium-capacity units insure a profit on the investment, whereas, the high cost, more elaborate equipment, heretofore necessary, invariably renders the venture unprofitable.

Original High-Capacity Stations

The successful commercial operation of standard medium-capacity units soon developed a demand for higher capacity stations, so arranged that even an abnormal lightning disturbance would seldom cause a service interruption. This demand was temporarily met by installing electrolytic lightning arresters ahead of the standard discharge horns. With this combination lightning disturbances were, as a rule, taken care of without service interruption.

This combination has, however, a serious commercial drawback, owing to the high initial and maintenance costs of the electrolytics. In many remotely located installations, it was practically impossible to give daily attendance, such as charging, inspection, expert supervision, etc., with the result that trouble ultimately developed.

Low-Cost High-Capacity Stations

The need for low-cost, high-capacity outdoor sub-station equipment has been successfully met by adding a special high-capacity lightning arrester to the medium capacity units, simply substituting this arrester for the standard discharge horns. Fig. 1 illustrates a single-pole high-capacity sub-station unit equipped with this new arrester. For single-phase and three-phase service, two or three units have their switches mechanically interlocked, thus enabling all phases to be simultaneously opened or closed.

The high-capacity lightning arrester, see Fig. 2, consists of two discharge horns, one of which is solid, insulated and adjustable; the other sectionalized and fixed in position. The lower section of the fixed horn is mounted on a steel ground post, an insulating section supporting tubes containing non-inductive resistance. To the outer ends of the insulating tubes and resistances are secured copper segments of the discharge horn—a small air gap being left between each segment. The resistances are connected in series, the steps being graded in value.

High-Speed Sphere Gap

Lightning and static disturbances of high frequency are rapidly discharged across the "high-speed sphere gap." This

gap having no series resistance furnishes an ideally free discharge path to earth, rapidly draining static.

Arrester Operation

Under lightning or abnormal static conditions, the incoming surge breaks across the straight line gap to ground—no resistance being in circuit. If the discharge is followed by line current the arc rises rapidly, due to the heated gases, the chimney-shaped gap increasing the rate of travel.

As the arc travels upward, passing from segment to segment, it automatically introduces resistance in series with the ground circuit, materially reducing the current flow. This resistance, increasing in value as the arc rises, insures a comparatively small arc, quickly suppressed on the diverging horns. Between the load and the incoming surge is located a powerful, specially formed choke coil, which reflects surges to the arrester.

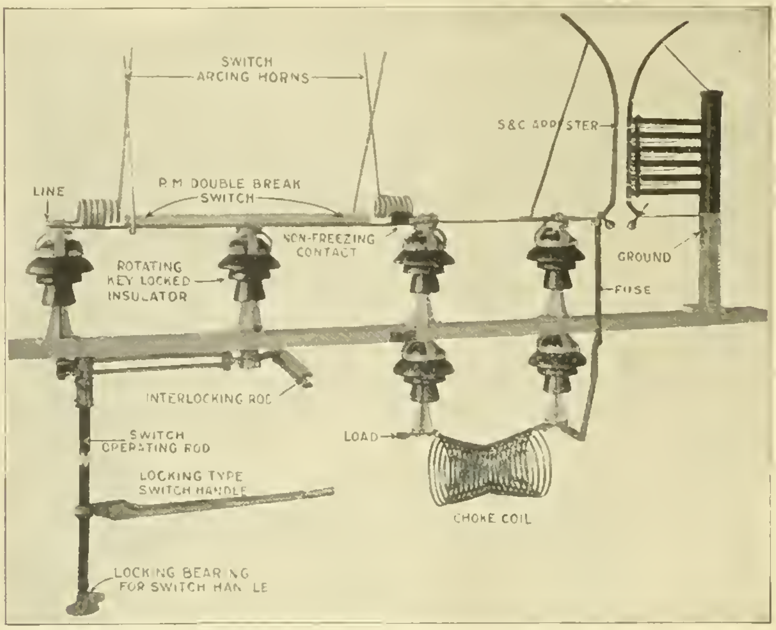


Fig. 1—Outdoor Sub-Station Unit, 100 k w to 2000 k w Capacity, 13200—66000 volts.

Straight Line Discharge Path

From a study of Figs. 1 and 2, it wil be seen that lightning has a "straight line" path to earth—there being no resistance between the lower section of the sectionalized horn and ground. The resistance comes into circuit only as the arc rises and thus performs its proper function—namely, to automatically limit the current flow and resultant arc.

No Series Resistance

The first qualification of a high-capacity lightning arrester is a low resistance "straight line" path to ground. The amount of resistance in the arrester ground circuit determines its effectiveness—the ideal arrester being one having no series resistance to impede the high frequency discharge. A static or lightning disturbance will, or will not, be drained from the system, just in the proportion that the arrester resistance permits charges to escape more or less rapidly than they reach the arrester. The high-capacity lightning arrester, see Fig. 2, eliminates "series" resistance which would impede the discharge to earth.

High vs. Low Resistance

With high resistance in the ground circuit, comparatively high potentials may still exist on the system—even while the arrester is discharging. With low, or no resistance in the ground circuit, high potential charges cannot be maintained at a dangerous value.

A "straight series" resistance in the ground circuit, sufficiently high to be of any value in limiting current flow, impedes the freedom of static discharge. If a low straight series resistance is used, the arrester will discharge more freely—but the current flow to ground will be increased.

Commercial Advantages

The commercial advantages of these lower cost high-capacity units will be quickly taken advantage of by transmission companies. Outdoor sub-stations can be installed at remote points as the arresters do not require daily charging, have no electrolyte to heat or freeze, film aging is eliminated discharge rate is high, there is no "straight series" resistance, the limit resistance can be established at any desired value—and frequent attendance, adjustments or inspections are unnecessary.

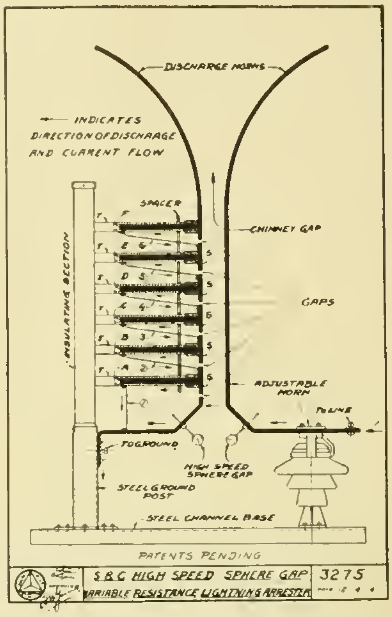


Fig. 2—Diagrammatic Sketch Showing Elements and Connections.

A—No. 1	Resistance	1	Ground Lead	
B—No. 2	"	2	Connects	A & B
C—No. 3	"	3	"	B & C
D—No. 4	"	4	"	C & D
E—No. 5	"	5	"	D & E
F—No. 6	"	6	"	E & F

"T" indicates insulating tubes.
"S" " copper segments.

Montreal Power Corporations

The position of Montreal as the centre of power corporations is dealt with in the annual report of the Board of Trade. It is stated: "The situation with respect to the public service corporations of the City of Montreal is becoming of great importance. Montreal is surrounded by a number of water powers the combined capacity of which, after development, has been estimated at not less than 500,000 horse-power. Assuming that 40 per cent. of this might be used outside the city, the advantages of that proportion would still be more or less tributary to Montreal, and that 300,000 horse-power would remain for the use of industries located in the city itself, and thus at least double the amount of electricity now sold in the city would be available for its use. During the past year the completion of the Cedars Rapids plant has added 100,000 horse-power to our supply, sixty per cent. of which is being sent over to the State of New York, leaving forty per cent. for Montreal. These facts show that Montreal is one of the greatest natural power centres in the world, and it would seem that its citizens should reap the advantage thereof. In this connection the Tramways situation has been arousing much interest, the company being desirous of obtaining an extension of its franchise upon the conditions of high-capacity outdoor sub-stations demand a "straight line" lightning discharge path and a high resistance path for limiting dynamic or line current.

Electric Railways

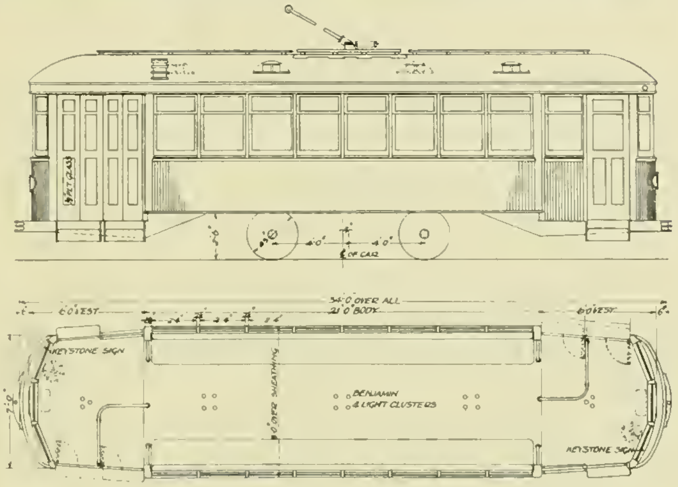
Brantford Now Has Up-to-date Rolling Stock—Under Municipal Management—Big Gain in Earnings

Five single end, single truck, pay-as-you-enter cars, and one double end car, were recently supplied by the Preston Car & Coach Company to the Brantford Municipal Railway System.

The under-frames are entirely of steel, and the side framing is also of steel, covered with wood. Exterior finish is natural cherry; interior finish, natural cherry; headlinings, three-ply veneer; seat arrangement is longitudinal; the front vestibule has seat along one side of it in the single end cars; the exit door, at the front end, is operated mutually with the

Interior view, one of the new Brantford cars.

step, and slides into a pocket in the side, the mechanism being under the control of the motorman, who can operate the door, and lower step, or vice versa, without moving from his position. The exit and entrance doors are, also, mutually operated with the steps, and are under the entire control of the conductor, who stands inside a railing on the rear platform. The electrical signal equipment is the Consolidated Car Heating Company's buzzer, operated from the trolley.



Plan and elevation of Brantford cars.

Cleveland fare boxes are installed on the rear platforms. Sign boxes, Keystone, one at each diagonal corner of vestibules, and one on the right hand side, about the middle of the car. The fenders are H. B. life guards; the trucks are Taylor extra heavy 8 ft. wheel base; the electrical equipment Westinghouse 101-B-2 motors with K-10 controllers. Seating capacity of each car 36. The total weight of each car 25,200 lbs. The height of the step from the street to the top of the first step 15 inches, from the top of step to the floor of vestibule 13 inches, from the floor of vestibule to floor of car body 10 inches. The floors are covered with heart-shaped steel matting manufactured by the Page Wire Fence Company, of Walkerville, Ontario. The curtains are pantasote, pattern H, color 74; curtain fixtures are Maple Leaf Eccentric as manufactured by the Dominion Bronze Company; ventilators are automatic.

Co-Operating

The Winnipeg Electric Railway Company have been, during the past few weeks, endeavouring to create a more friendly feeling of co-operation with the citizens by the publication in the daily papers of interesting statistics and data concerning the operation of their street railway system. By means of these intimate "Street Car Talks," the public are acquainted with a few of the many uncontrollable situations tending to disorganize their schedules and are taught that by co-operating with the company a great many of the present difficulties may be overcome. The Winnipeg Electric Railway Company have with the approval of the Utilities Commissioner, eliminated a number of stops on their different lines with the object of improving their schedules.

Mr. A. E. Westman, superintendent Windsor, Essex and Lake Shore Railway Company, was accidentally killed by coming in contact with a live wire on December 21st, at the Kingsville power house.

Underground Conduit Work

By W. N. Dietrich

In recent years there has been a more or less constant agitation against overhead wires in cities and large towns and along congested lines of railway tracks, and, as a natural result electrical subway construction is a matter that is becoming increasingly important every year. In the city of Montreal and vicinity all construction of this nature has been placed under the supervision of the Montreal Electrical Service Commission.

Where subway electrical construction has to be undertaken hurriedly there is usually a strong tendency to adopt a type of very poor construction in order to cover the most territory with the least possible investment.

Of the various kinds of equipment that go to make up an electric light and power, telephone, fire alarm or burglar alarm system the part least subject to depreciation is underground conduit. This part of the installation, if properly installed, will last for a great many years.

Future Development Study

The designing of an electrical distribution system should be preceded by a careful development study, as, even with the most painstaking and searching investigation, it is difficult to closely approximate what the development will be in a few years, and it can readily be understood how easy it would be to make costly errors in determining the capacity of a system of underground construction unless very great care is taken in this development study. An underground conduit system is the cheapest in the end.

With underground conduits designed with due regard to the condition to be taken care of, their installation will invariably result in economy of operation and maintenance and will be a great benefit to the community by the removal of unsightly poles and wires on the principal streets. In the opinion of the writer, the officials of many electric light and telephone companies in the smaller cities and towns would like to put their wires underground were it not for the fact that the data they have been able to obtain relative to the cost of conduit system has shown that the necessary expenditure would be unwarranted. It will however be found that in many cases the cost figures upon which they have based their conclusions are the cost of conduits for large cities where the conditions are entirely different from those existing in the smaller communities.

There is no question but that the cost of underground construction is somewhat greater than that of aerial, but when once a conduit is installed **it is there to stay** with maintenance expense reduced to a **negligible** quantity; whereas with the aerial lines every manager knows the **high depreciation and renewal percentages** that are necessary to keep his lines in perfect order. When we add to this the serious interruption to business and necessary expenses attending a single winter storm, a very forcible argument for underground installation presents itself.

As the purpose of this paper is a short description of the methods usually adopted in this country in the construction of an electric light or telephone conduit system for ordinary conditions, we will assume a problem such as might be met with in an ordinary town.

First, correct plans of the location should be obtained and if the layout of the electrical construction is not accurately shown this data should be procured and transferred to plans. A careful study of the probable growth and development should be made and this information should also be recorded on the plans. With this information secured, a personal inspection of local conditions should be made with a view to determining the streets in which to build the conduit and to decide the number of ducts to install in the various parts of the town. This preliminary study well carried out will avoid expensive alterations and additions when the usual growth in business takes place.

Having located the ducts, the next step is that of determining the most suitable location for the manholes. The most important point in this connection is to locate as accurately as possible the position of gas, water, sewer, and other services beneath the surface of the streets, being especially particular about ascertaining the exact depth below the surface. As a general rule more or less accurate data regarding this may be obtained from the local public service companies and municipal authorities, but it is usually of advantage to verify any such information by digging a few test pits at various points in the vicinity of the proposed installation.

Generally speaking, in this country the water pipes have to be placed at least five feet below the surface to avoid the frost; and the gas mains are usually placed a little above this main. It will usually be found that the best place for the main line conduits is immediately above the water main, taking care to avoid, as far as possible, the gas main which is generally a source of considerable trouble. The service connections for house connections, street lights, burglar and fire alarms, etc., are usually run near the surface. Ample consideration should be given to the number of ducts required for each class of service by conferring with the officials of the Public Service Corporation or town representatives.

After the conduit, should come the consideration of the size, number, and location of the manholes. In order to permit of suitable intersections for the branch lines and provide proper drainage of the ducts it is usual to place the manholes at the street corners. They should be designed by a competent engineer who will naturally make provision for any apparatus they have to contain, and will make them of such depth and size that they will conform to the number of ducts entering them.

Just here it might be as well for the benefit of those who have not given much thought to underground conduits to describe briefly the materials entering into the construction of an ordinary system.

Properties of Duct Material

Duct material from which conduit is to be built should possess the following properties:

(1) It should be inexpensive to obtain.

(2) It should be strong and tough, so that excessive breakage may not occur during installation and so that it will afford sufficient protection to the circuit it encloses.

(3) When laid it should afford a smooth hole into which cables can be readily installed or withdrawn without injury to their sheaths.

(4) The duct material should be so designed that, when successive pieces are laid, the ends may be self-centering and preserve the alignment of the holes in the successive pieces to prevent discontinuity at the joints.

(5) The material should be such as not to in any way injure the cable after it is installed, and should be proof against any form of deterioration or decay when buried in the earth.

(6) After being laid, the duct material should be as nearly as possible moisture-proof and gas-proof.

(7) Other things being equal that duct material is preferable which can be laid with the least expense.

There is no duct material made at the present time and known to the writer which fills all these conditions, but several forms are manufactured from which it is possible for the engineer to select one which on the whole will reasonably suit, and from which a commercially successful conduit can be constructed at a reasonable cost.

There are five commercial duct materials, which may be divided into three different classes as follows:

(1) Conduits of metal material;
(2) Conduits of vegetable material;
(3) Conduits of silicious material.

In the first class are wrought iron pipe and cement lined wrought iron pipe. In the second class are creosoted wood duct and bituminized wood pulp duct. In the third class are vitrified clay conduit and monolithic concrete or cement conduit.

Iron pipe makes an excellent subway but while it has the advantage that it can be bent and twisted almost at will, its cost is so great that it can only be used under exceptional circumstances, such as for continuing a conduit over a bridge or trestle, or for terminating a lateral, or for a short subsiding conduit, or for surmounting the complicated obstacles presented by the network of underground obstructions sometimes found beneath the streets. In other cases the cheaper competitors are to be preferred.

Cement lined pipe has not proved very satisfactory on account of erosion and consequent short life, and when the iron corrodes in the concrete its surface is more or less rough.

The wood duct is usually made in 4-ft. lengths with male and female ends so that successive pieces may be fitted together, producing a duct that is practically air and water-tight. It has the advantage that it can be laid very cheaply as it is only necessary to excavate the trench, lay the log on the bottom thereof, refill the excavation and replace the pavement. Untreated wood rots rapidly, but properly creosoted it becomes a reasonably durable structure lasting from 15 to 20 years.


Showing service pipes.


Excavation for service manhole.

Bituminized fibre conduit is a duct material which possesses a number of advantages. It consists of tubes made by rolling paper with asphalt or other bituminous compound around a mandril. The tubes are made about 6-ft. long, furnished with male and female ends to secure alignment and a tight joint, and can be obtained in a variety of duct sizes. This material is waterproof, very light, can be laid with great rapidity, and in the opinion of some experts it is better than its principal competitor the clay duct, but its extra cost usually about offsets its lightness and ease of laying.

The most popular conduit is the so-called vitrified clay duct. It first appeared under the name of hollow brick. It is a tile about 18 ins. long and 3.625 ins. outside diameter. After the trench is excavated and a bed of concrete laid the conduit is built by laying the hollow bricks in mortar one on top of another, and side by side, exactly as a brick wall is built. To keep the hollow brick in line with the centre of the trench in which the conduit is being built, the bricks are laid on a mandril consisting of a round piece of wood about three feet in length, having a ring at one end and a leather washer at the other. The ring enables the mason, who is supplied with a long hook, to pull the mandril along as fast as he lays the brick, while the leather washer scrapes away the superfluous mortar and leaves the duct reasonably clean. One enterprising manufacturer improves the alignment by moulding two holes about 0.25 in. in diameter in the end of each duct, into which dowel pins are inserted and the succeeding duct centred by being placed on the pins. Another makes a form of hollow brick that closely resembles a pump log, either square or round, and supplied with male and female ends.

All hollow brick tile should be of good finely ground clay mixed in the proper proportions and burned thoroughly hard right through. Each piece should be well vitrified, but should not be burned so hard as to be fused or scoriated. The surface of each piece, both inside and out, should be thoroughly and uniformly glazed with good salt glaze and should not contain cracks which extend into the surface more than 0.0625 in. Each piece should be sound, without soft spots, stones, gravel or any other imperfections. Each piece should be straight and true, and fully up to dimensions specified. The bore of each should be tested and should pass a standard 3.1857-in. gauge. All pieces having a bow or curve or kink of more than 0.25 in. should be rejected. The maker should scrape each piece through the inside of the bore by an appropriate scraper or cleaner.

Hollow brick requires skilled labor to lay it because the trade unions claim that as a trowel is used conduits must be classed as masonry. The multiple duct has been invented to cheapen cost of placing, both by lessening the number of pieces to be handled, and by enabling the work to be done by unskilled labor. This is a tile usually about three feet in length containing from two to sixteen ducts.

Manholes—May be made of any desired shape, form or size that suits the taste or judgment of the designer. Owing to obstacles it is sometimes impossible to build the usual type of vaults, and the engineer must make the best of the opportunities afforded him, but it is always a mistake to build vaults too small. The demands of electrical circuits are constantly increasing. More and more cables must be installed, and when the vault is crowded with cables it is almost impossible to work among the circuits without causing derangement, and in a cramped and confined space more time is expended in splicing and drawing in and out, so that it is false economy to restrict the size of vaults.

Manholes are built of either brick or concrete. If the latter material is used they may be monolithic structures made by covering the bottom of the excavation with a layer of concrete to form a floor, placing upon this a proper mould and ramming round the mould fresh concrete. After this concrete is set, the mould is taken apart and removed from the orifice provided for the manhole cover. The concrete manholes may also be built by moulding large concrete blocks of the appropriate shape and size, and afterwards laying these blocks, much in the same way that a brick manhole is built. The concrete manhole possesses the double advantage of being cheaper and more durable than the brick manhole.

The vault cover is invariably made of cast iron. It is usually a circular ring, varying approximately from about 22 to 28 ins. in diameter, provided with a substantial flange that rests upon the masonry of the manhole and closed by a solid cover strong enough to bear the impact of the heaviest truck.

It was formerly considered desirable to have waterproof covers to prevent the bulk of rain water from entering the

(Concluded on page 44.)

The Dealer and Contractor

Breakfast for Half a Cent

There are now many localities in Ontario where the ultimate price of electric current to the consumer is less than one cent per kw.h. This does not mean necessarily that the price of current to the average consumer has been appreciably reduced, but it does mean that, if the dealer bestirs himself and succeeds in inducing the householder to be a little bit prodigal in the use of electric energy, there is an ultimate reward to the consumer which is indeed well worth striving for.

The system of charging that has recently been adopted by the Hydro-electric Power Commission of Ontario is entirely commendable in this respect,—it is an alluring bait for the consumer to use all the electric energy he possibly can. To this end, the rates have been so adjusted that it is in the consumer's interest to make as liberal use as possible of all the various little luxurious utilities now available for the home.

This should therefore mean a harvest for the dealer who handles this type of equipment. But, like other crops, it does not harvest itself,—we have got to go out and gather it.

Just let us sit down and see what some of the talking points now are, on a cost basis, in favor of a more general use of electrical devices in and around the home.

Electric Iron—An electric iron consumes, say, on an average, 500 watts. This means a consumption of one kw.h. in two hours. Two hours probably represents all an iron is used in the average home in a week, so that a week's ironing costs about one cent.

Electric Sweeper—It probably is not recognized that an electric sweeper is one of the cheapest utensils in the home to operate. There are many small and efficient machines now on the market that only consume about 100 watts. Such a sweeper can thus be operated for nine or ten hours on a consumption of one kw.h., which costs one cent. This length of time probably represents the requirements of most houses per week and possibly per month. So the sweeping in the average home can now be taken care of at a cost of about one cent per month.

Electric Toaster—The average toaster requires about 5 minutes to make the first two pieces and another 5 minutes to make the next four pieces. Supposing the average requirement is six pieces of toast. This means 10 minutes use of about 500 watts. Counting thirty days, this toaster will be used 300 minutes or 5 hours per month, and consumes therefore 2,500 watt hours, or 2½ kw.h. This means that the cost of a toaster which produces six pieces of toast every morning is only 2½ cents a month. If the toaster is used longer each morning, it is still more economical.

Electric Coffee—A coffee percolator large enough for the average family consumes also approximately 500 watts. The coffee begins to percolate in this utensil in 30 seconds after the current is turned on, and probably gives the best results after about 10 minutes or, at most, 15 minutes. This means eight mornings before one kw.h. has been consumed, or a consumption of about 4 kw.h., costing 4 cents, per month.

Electric Stoves, etc.—Instances of this sort might be quoted at great length. A small hotplate uses approximately the same amount as a toaster or electric iron and can be used to fry bacon or attend to any of the minor details in the preparation of our three meals a day. A tea samovar consumes again about the same amount and would be required only for about 10 or 15 minutes at a sitting. Electric kettles with self-contained units use about 500 or 600 watts and raise water to the boiling point in about 10 minutes.

It will thus be seen that the cost of the operation of household utensils has reached a point where it compares more than favorably with cooking by gas or coal These utensils have the great advantage that they can be operated wherever, and whenever, it suits the convenience or whim of the person operating them

Cost of preparing breakfast—It is interesting to compare the use of these utensils in the preparation of a breakfast with its preparation on a coal range. To begin with, the coal range has either to be kept alive from seven o'clock the previous evening until seven o'clock in the morning, or lighted in the morning, which, in the one case, is expensive, and in the other case is tedious, dirty and troublesome. The ordinary breakfast will consist of, say, cereal, toast, bacon and coffee. The toast is made in 10 minutes on the table at a cost, as shown above, of 1-12 cent; the bacon will fry in 5 minutes at a cost of 1-24 cent; the cereal on a small hotplate which consumes less than 500 watts can be well prepared in half an hour at a cost of ¼ cent and the coffee percolated for 15 minutes at a cost of ⅛ cent. The total cost of cooking a breakfast for an average family using these three utensils is therefore 1-12 plus 1-24 plus ¼ plus ⅛ cent, equals ½ cent.

This is using three utensils which, in a properly equipped home, would be plugged into flush receptacles at the side of the table. Of course, the general way is to drop a reinforced cord from the electrolier, and this, while rather unsightly, is very efficient. In new homes however this method should be dispensed with as far as possible.

Is it not up to the central station, to the dealer and to the contractor to make these facts as widely known as possible? We believe the figures given above will bear the minutest inspection. It is actually possible, at the rate quoted, to prepare all the breakfast a family needs, or would use if they got it for nothing, at a cost of ½ cent.

Electric Ranges—The field is now opened for the much more general use of electric ranges. The value of electric ranges and their practicability are not appreciated we believe. The initial cost has been the biggest obstacle in their more general use, however. With a wider use the original cost will no doubt be greatly reduced, and if manufacturers and dealers could co-operate in this respect, it is reasonable to expect that many times the number of ranges would be sold under the new rates, as have been sold in the past. Reliable operation figures are not easily available, but we hope to be able to publish some valuable data in the very near future. We are confident this will show that electric cooking at the

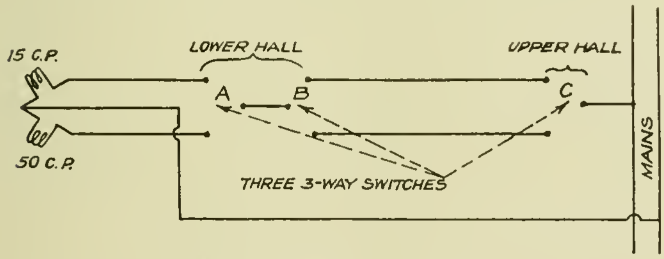
present rates of electric energy at many points in Ontario, is appreciably cheaper than cooking with coal or gas.

Electric Heating—Even electric heating is brought within the range of possibility by the new rates. Many a furnace is run at high pressure so that one particular room in the house may be kept at a certain temperature. Probably it would be sufficient in the rest of the house if the temperature were ten or fifteen degrees lower than in this particular room. Yet the coal consumption is almost doubled in order to obtain the desired amount of warmth at this one spot. Such a condition could be cared for by running the furnace normally and using a small electric heater as an auxiliary, consuming 500 watts or at most 1,000 watts per hour, at a cost of ½ cent or one cent per hour. It may be that the higher temperature is only required for one or two hours each day in this particular spot and thus for the expenditure of a cent or two a very great saving is made both in coal and labor.

The new rates have opened a big and fruitful field and introduced very attractive possibilities for the dealer and contractor which will of course react favorably on the jobber and manufacturer. Get after this new business to-day. There will never be a better chance or a more opportune time

Control of Hall Lights

The value of the proper control of one's electric lights may not be appreciated beforehand by every man who is building a home, but it is safe to say that no electrical contractor ever got into trouble by using his own discretion in the direction of improvements and refinements in the way of better electric control or more electrical conveniences. This is a case where the contractor is justified in using his influence to the fullest extent, because the householder does not, in the vast majority of cases, appreciate the value and the possibilities of the little refinements in the use of electricity which go to make up the difference between evenings spent in comfort and inexpensive luxury, and evenings spent in the old-fashioned way largely because they were good enough for our fathers and mothers. It is more than probable, however, that, if the fathers and mothers of most of us had been possessed of much of the knowledge that is



Ideal control by three 3-way switches.

common in this day and generation, they would have made much better use of it and much more progress under it than we are doing.

One of the little inexpensive refinements which add practically nothing to the sum-total of the expense of the installation is shown in the accompanying sketch. It has reference to the control of the lights in the first and second floor halls of a residence. Of course no house is to-day considered to be properly equipped by the electrical contractor unless the light in the down-stairs hall is controlled also from up-stairs, and the light in the up-stairs hall controlled from down-stairs. In the average size house, it is not generally considered worth while carrying this practice into the attic, though at a very small expense this can of course be done.

The illustration, however, represents a further refinement in the control of the lights in the down-stairs hall. For example, the average householder would prefer not to have too bright an illumination in his hallway under ordinary circumstances, but prefers possibly ten-candle power or less burning during the evening or may be through the night. When the hall is to be used, however, a better illumination is required, say fifty candle power. The diagram shown herewith illustrates how this control may be accomplished. Three 3-way switches are installed as shown,—A, B and C. The switches A and B are placed side by side in the lower hall, and the switch C is placed in the upper hall in the usual way for the control of the lower hall lights. In the drawing, the switch B controls the light in the lower hall, that is, to turn it on or off. Switch A is purely for selective purposes, so that the householder may change over at will from (say) 5 to 50 candle power and vice versa. It will be noted that the switch A will not, under any circumstances turn the lights off if they are on, or on if they are off; it is purely selective. On the other hand, the switches B and C will, either of them, turn off whichever light happens to be burning and will of course turn the same light on again.

Two lamps of some such ratio as this, enclosed in a semi-indirect bowl, form a very handsome and efficient light fixture for the main hallway of any residence. All the extra expense incurred is a third wire from the switch A to the hall outlet together with the cost of the switch A.

Status of the Electrical Contractor

The following letter has been received in reply to Mr. Geo. J. Beattie's communication in our issue of January 15th, which dealt with the status of the electrical contractor and the possibilities of improving conditions in the Canadian electrical contracting field. The letter will be read with interest as expressing the point of view of a man who has had practical experience in the field.

Editor Electrical News,
Toronto, Ont.

Herewith you will find what I think of the electrical contracting business in Brantford and half a dozen other cities I have in mind.

The electric business from the manufacturer to jobber and dealer seems to be a cut-throat business from beginning to end.

The manufacturer is continually fighting the other fellow to try to put him out of business. Perhaps he keeps at it till he does put one of his competitors to the wall, but what has he gained? Some other company starts up and as, perhaps, he has spent all his spare capital putting the other fellow down, he may be the next to go to the wall, especially if some other firm wishes to continue the price cutting war.

The jobber is something like the manufacturer. He sends his traveller out to get business. This traveller makes his call on the dealer who says, "Oh! you are high on your prices. I can buy far better than that, but if you will meet the other fellow's price you can have the business." So the traveller calls up long distance and gets permission to meet the price, or meets it of his own accord. Next day No. 1 comes in to get the business the dealer has given No. 2 and is told that No. 2 got the order because he was there first and had just as good prices. In a great many cases, No. 1 will say he can do better than that, if the dealer will give him the order, and so it goes on, and the first thing you know one of the jobbers has gone to the wall.

Now, I think it would be far better for each man to set his prices and stick to them. Our firm has found that more satisfactory and better service is obtained from firms that stick to their prices.

One more fault some of the jobbers have is to call on, first, the dealer and then on the factories and sell to the latter at exactly the same prices as they do to the dealer, and in some cases they go one better and quote the factories

lower than they do the dealer. Until such time as the jobber ceases to do business that way, there will be nothing but ill feeling between the jobber and dealer.

The dealer, in most towns and cities, is sore enough at his competitor that he feels like putting a bomb under the other fellow every time that other fellow gets a contract that he thinks he himself ought to have had. Now, this feeling would not exist if they were to get better prices, and I think this would be improved by compelling the dealer to take out a license as suggested in (1) of Mr. Beattie's article.

I would go still farther and make the workman pass an examination, and give him a certificate that must be renewed each year. This would prevent so many young fellows working about one year as contractors' helpers and then going into business for themselves.

Articles (2), (3) and (4) are all right, but I believe (1) is the most important.

Yours truly,
Doeringer Electric & Repair Co.,
(Signed) Algar W. Doeringer,
Manager.

With the Jovian Order

At a recent election of the Winnipeg branch of the Jovian Order the following list of officers were appointed,—First Tribune, Geo. L. Guy; Second Tribune, J. H. Schumacher; Secretary-Treasurer, W. E. Skinner. At this meeting it was also decided to establish a Jovian League for the purpose of looking after the social affairs of the Order. The following officers of the league were elected:—President, W. H. Billing; Vice-President, J. S. Madden; Secretary-Treasurer, W. E. Skinner; Executive Committee, F. H. Wilson, F. W. Miller, Thos. Carlyle and J. S. Henry. Fortnightly luncheons are held at the St. Regis Hotel at which an address is delivered by prominent Winnipeg men or out of town visitors. The quality of these addresses may be judged by citing the last three:—Mr J. H. Reynolds, Commissioner of the Greater Winnipeg Water District; Rev. W. J. Hindley, ex-mayor of Spokane, and S. R. Tarr, managing director of the Canadian Finance. A rejuvenation of the Order was held at the Royal Alexandra Hotel on January 20th, at which a number of men prominent in electrical and allied professions were admitted to membership.

Spirit of Co-operation in Montreal

With the object of furthering the spirit of co-operation among Montreal Jovians, the local league has arranged for a series of lunches, to be held weekly at Cooper's Restaurant, and also a smoking concert once a month. Every alternate week an address will be given at the lunches. The first speaker was Prof. Alex. Gray, of McGill, who on January 21 spoke on "New Standardization of Electrical Machinery." He referred to the great improvements in motors, especially in the matter of ventilation, pointing out however that the standardized rules were never followed so far as heating is concerned. Prof. Gray then discussed the proposed Institute rules as to the use of materials in relation to the factor of safety—cotton and paper put in dry without any treatment; cotton and paper impregnated with compounds; other materials such as mica, without cotton or paper. The manufacturers had not yet decided upon their types, under these new rules, and were apparently each watching to see what the other would do. He believed that the tendency would be to make smaller machines for the same output, but what the exact changes would be it was hard to say.

Winnipeg Jovians Hold Biggest Event of the Year

The annual Rejuvenation of the Jovian Order in Winnipeg was held in the Royal Alexandra Hotel, Wednesday evening, January 20th. The rites of initiation were executed by the Degree Team of the Immortals, personified by Geo. L. Guy, Jupiter; J. H. Schumacher, Pluto; J. B. Minns, Neptune; W. H. Reynolds, Hercules; Frank E. Filer, Vulcan; W. E. Skinner, Mercury; F. W. Miller, Mars; F. W. Patterson, Apollo, and C. R. Richardson, Avrenim.

The one hundred and four Jovians present, following the Rejuvenation, sat down to a banquet. A Chief Stentor of the Jovian Order, Mr. Carancross, of Chicago, recited his famous "Ode to Electricity." Messrs. Gibson and Bowie sang several solos. Mr. Cousins responded to the toast "The Boys at the Front." Judge Robson responded to Mr. Duff's toast "The Newly Elected Jovians" on behalf of the entire class and thanked especially the four who suffered the wrath of Jove as the sacrificial offering of the entire class of thirty-nine. Some of the more prominent in this class, in addition to the Hon. Justice Robson, Manitoba Commissioner of Public Utilities, were J. G. Glassco, Manager City Light & Power Department; F. A. Cambridge, City Electrician; Geo. A. Watson, Commissioner of Manitoba Government Telephones; W. G. Chase, Chief Engineer of the Greater Winnipeg Water District, and Prof. E. Brydone-Jack.

The members were also well entertained by the expert ventriloquist, Mr. Lester. Mr. W. A. Duff recited from Dr. Henry Drummond. A toast in the form of a vote of thanks was extended to Mr. Geo. Guy, First Tribune, and his co-workers, and the evening concluded with "God Save the King."

Should be Separate Department

The newly appointed electrical inspector for the city of Toronto, Mr J. Shields, is asking that his department should be kept entirely separate from the architect's department. The request is entirely reasonable and we have no doubt meets with the approval of both the provincial and the local Commissions. It would be absolutely ridiculous to place a technical department such as the electrical inspection department must become, under what is practically a non-technical department. Architects do not, could not be expected to, and few of them any longer claim to, have any knowledge whatever with reference to electrical matters and much better results are certain to be obtained if the electrical inspection department stands on its own feet and carries its own responsibilities. There is no doubt either that the amount of work entailed by this department is both sufficiently large and important to justify its being placed under an independent head. By all means make Mr. Shields entirely independent of the architect's and all other departments, and the same should apply to every other town. This does not mean, of course, that there ought not to be co-operation between departments, but it must be recognized that the electrical inspection department co-operates on an equal footing and not in any sense as a subsidiary. It is a technical department becoming daily more technical, and only men specially schooled and trained in the work are capable of controlling it or of giving advice with reference to its control.

The Bureau of Standards, Washington, D.C., have just published a number of scientific papers, treating of various electrical and allied subjects. No. 220 is entitled, "The silver volt-ammeter"; No. 218, "The comparison of the silver and iodine volt-ammeters and the determination of the faraday"; No. 223, "The testing of potentiometers"; No. 225, "Adjustments of the Thompson bridge in the measurement of very low resistances"; No. 228, "An experimental study of the Koepel permeameter"; No. 6, "Fees for electric, magnetic and photometric testing"; No. 31, "Copper wire tables"; No. 34, "The relation of the horse power to the kilowatt."

Running Conductors to Side Outlets

in Finished-Building Wiring—Useful Hints on This Difficult Work

By Terrell Croft*

Running wires to switch and fixture outlets in partitions is probably the most difficult work encountered in the wiring of finished buildings. A considerable percentage of the total wiring lies within partitions, and great ingenuity must often be displayed in running the conductors to specified outlets without damaging the walls. Where there is no bracing or other obstruction within a partition and the header can be reached from an attic or by removing floor boards, the operation is simple. A hole is bored in the header, a "mouse" (Fig 1) is dropped through and the wires are pulled up, by attaching them to the mouse string, from the outlet hole in the partition to the hole in the header. All wires within partitions and in other places where they cannot be sup-

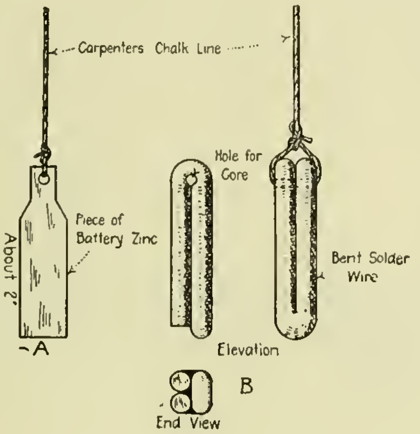


Fig. 1—Details of mouse construction.

ported on porcelain must be sheathed in circular loom, which is slipped over the wires before they are pulled in.

There are several methods of getting conductors past obstructions to wall and partition outlets. In a great many cases, the bringing out of the switch loops at outlets at a proper distance from the floor is the most exacting feature of wiring old houses, on account of the cross pieces or bridges sometimes found in partitions. The method to be used must be determined by the wireman on the job, according to the conditions found. The procedure is as follows:

First, with his mouse, he finds if the runway is clear; if so, the rest is easy. But, if he finds there are cross-pieces, he locates their position by measurement with the mouse, and marks the location on the wall. If the cross-pieces are above the proper position for the switch, he will probably use one of the following methods (which are described in detail later) of getting around them:

(a) Remove the door stop strip from the frame of the doorway, bore through on each side of the cross-piece, and cut a recess in the inside of the frame; then fish the wires around.

(b) If on the second floor, and there is no partition directly above, the wireman can use a pipe-extension boring tool, boring one hole large enough to fish the switch loop through.

(c) If the cross-piece is not too far above the proposed location of the switch, the holes can be drilled on a slant from the switch opening. (See Fig. 2.)

(d) Remove the wallpaper directly over the cross-piece. Then cut a hole and bore holes or cut away the cross-piece so that the wires will pass.

(e) Sometimes a wireman will attempt to remove these cross-pieces when he can get at them from above, by putting a piece of pipe down between the partition, and hitting with a heavy hammer. This method is liable to cause damage to the plaster by bulging or breaking out, and is not recommended.

(f) When a switch must be located on a brick wall, it is necessary to run wires in rigid or flexible steel conduit. The wall must be channeled, and the conductor buried in it, and the groove re-plastered. At the point where the metal terminates under the floor, a suitable outlet fitting must be provided.

When a partition outlet is near a doorway, the vertical conductors can be run past bridges within a partition by removing the door jamb and following the method illustrated in Fig. 3. In the case shown it was not feasible to bore down from above with the long-distance boring tool,

*In Electrical Review.

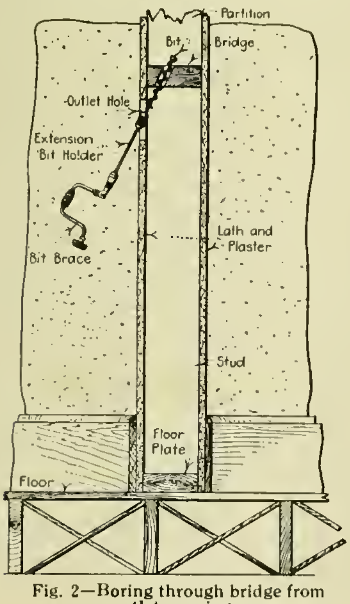


Fig. 2—Boring through bridge from outlet opening.

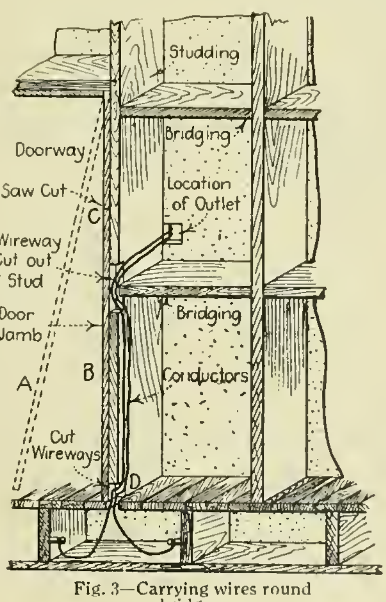


Fig. 3—Carrying wires round a bridge.

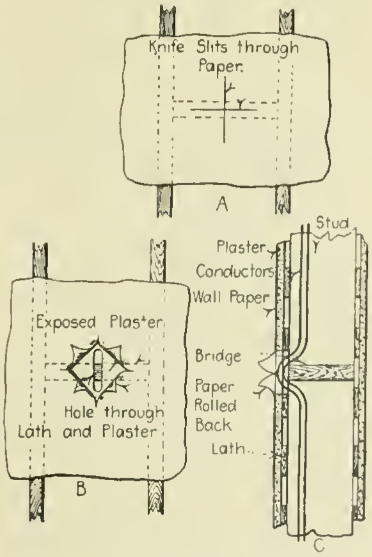


Fig. 4—Method of cutting into plaster.

so the conductors were carried up from below. The door jamb in such a case can either be pried loose and bent up, as shown at A, Fig. 3, or a saw cut can be made in the jamb as at C, and the section B of the jamb can be removed. In either case, the stud at the side of the door is exposed and a wireway can be cut in its outer surface around bridges or other obstructions as shown. At the floor a hole can be cut through the stud, as shown at D, and through this hole another can be bored through the floor. The conductors are then carried through this floor hole into the space between the joists. The building code of most municipalities requires that all conductors within partitions and not supported on

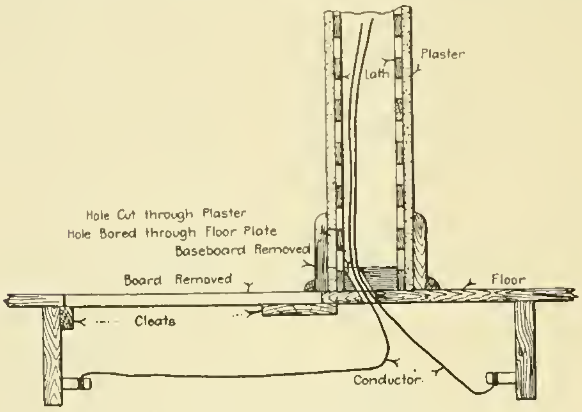


Fig. 5—Method of cutting through sill.

porcelain be carried in circular loom. Allowance must be made for this in boring holes and cutting wireways.

To carry conductors past a bridge in a wall when a doorway is not adjacent and when the long-distance boring tool is not applicable, it is necessary to cut into the surface of the wall as shown at Fig. 4, and as described in the following paragraph. Through the bared plaster cut holes into the partition above and below the bridge, and remove enough plaster from in front of the bridge to leave a cavity that will accommodate the loom-covered conductors. The conductors may then be run in as suggested in the longitudinal section C. The hole left in the wall surface should be filled with

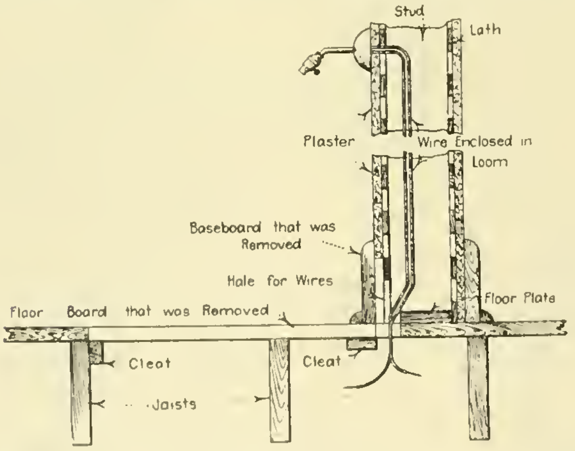


Fig. 6—Method of wiring around sill.

plaster of Paris and the paper carefully replaced as described in the following paragraph.

A method of cutting wallpaper to expose plaster for making a fishing hole without disfiguring the wall decoration is illustrated by A and B of Fig. 4. With certain kinds of wallpaper the method here described can be used with practically no visible damage. If the wallpaper is such that moisture will disfigure it, this method should not be used. Cartridge papers are not, as a rule, affected by a little water. In order to ascertain the effect of water on the paper in question, it will be necessary to experiment with a small area in an inconspicuous corner.

If the paper stands the test, two slits can be cut through it at right angles to each other, as shown at A of the illustration, at a point just opposite the bridge. The bridge can be located by dropping a mouse on it from the outlet hole cut through the partition at a point above it. A very sharp knife should be used in cutting the slits.

Ordinarily the paper should be soaked slightly around the slits with a wet sponge or cloth. When the water has been absorbed by the paper, and the paste that held it to the wall has softened, peel back the four triangular sections of paper. A wide-bladed putty knife is a convenient tool for the purpose. Be careful not to crack or crease the paper. In old buildings where there are many thicknesses of paper on the wall, they can, frequently, be removed without moistening. When the paper is completely peeled it will appear as shown as B.

Should there happen to be a figure or a flower in the wallpaper design directly over the bridge within the wall, the double slit is not made, but instead, the entire design is cut out of the wallpaper with a sharp knife.

A hole is now made through the laths and plaster to accommodate the conductors and they are drawn in. After they are in, the hole is filled with plaster of Paris and the design can be replaced on the wall so neatly that the casual

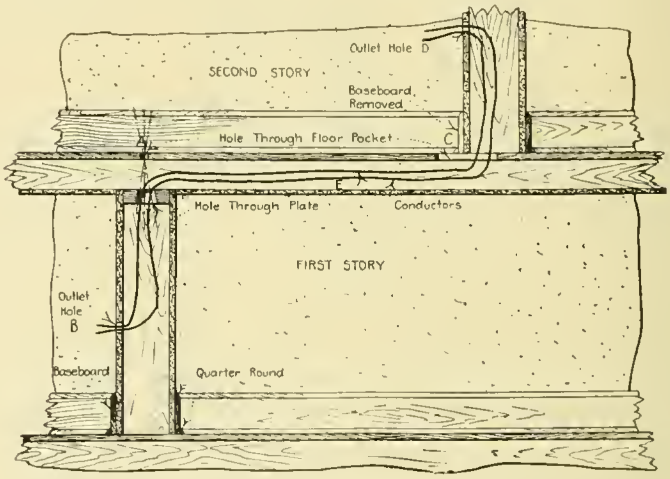


Fig. 7—Fishing between partitions on different floors.

observer will not know that the paper was cut. The hole in the plaster should always be somewhat smaller than the piece of paper removed from the wall.

A 2-by-4-inch sill is sometimes placed under the lower ends of studs that form a partition, as shown in Fig. 5. Where this construction is encountered and it is not possible to bore through the sill from above with the pipe-extension boring tool, the baseboard must be removed as shown. After the baseboard is off, an orifice is cut through the lath and plaster and a slanting hole is bored through the sill and the floor. Sometimes it is not necessary to bore the hole, as the wires can be run in a space formed by removing some lath and plaster, as suggested in Fig. 6. Where large conductors are involved it is usually necessary to bore through the sill.

Often the condition illustrated in Fig. 7 is encountered. It is necessary to draw conductors from an outlet in a partition in one storey to an outlet in a partition in another storey. Where the partition of the storey above lines up with that of the storey below, the conductors can usually be drawn in by cutting a pocket close to the foot of the partition in the second storey. Where, as in Fig. 7, the partitions do not line up, it is more difficult to get the conductors in without disfiguring the building. Frequently the partition in the lower storey lies under a hall or other second-storey room

that has a nicely finished bare floor from which the wireman does not dare to remove boards.

One solution of the problem is to bore one five-eighths or three-fourths-inch hole directly over the plate of the first-storey partition as indicated at A. Then through this hole, by pitching the bit and using one having a long shank or an extension bit, a half-dozen holes can be bored through the plate—all through the one centre hole in the floor. Instead of making several small holes in the plate it is possible to make one large one by boring the small holes around in a circle and then knocking out tbe block with a bar or a piece of conduit. To draw in the conductors: A mouse or a fish chain is dropped in at A, and pulled out at B. Then a snake is pushed in at C, through E, and drawn out with a hooked probe at A. The snake and fish wire are fastened together at A and the chain is drawn by the snake over to C. Now the conductors are fastened to the lower end of the fish chain which is extending from B and the conductors are pulled in over to C. From C the conductors are readily drawn up to D.

A plug of suitable wood, cut across the grain, and tapering so that it will fit nicely, is made for the hole A and driven

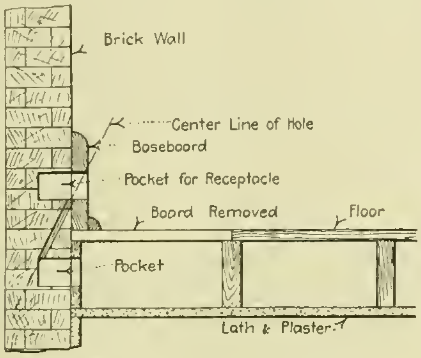


Fig. 8 Receptacle pockets in brick wall.

therein. Its top can be planed off flush with the surface of the floor and if its grain was selected to match that of the floor it will be difficult to locate.

A receptacle for an extension plug mounted in a baseboard is a good substitute for a wall fixture when it is objectionable to channel the brick wall to the regulation bracket height of 4 feet 6 inches. The method is illustrated in Fig. 8. By means of an extension cord a portable or table lamp can be substituted for the wall fixture. It will be noted from the figure that it is not necessary even to remove the baseboard. A slanting hole is drilled from the pocket for the baseboard receptacle to another pocket cut beneath the floor. A short piece of conduit is then installed from the receptacle outlet to the pocket under the floor. Such a baseboard receptacle also forms a convenient means of attachment for portable vacuum cleaners and various heating devices.

Sudbury's White Way

The town of Sudbury, Ont., has just installed some fifty ornamental luminous arc lamps of 6.6 ampere capacity each. The lamps are mounted on ornamental cast-iron standards, set 100 ft. apart on both sides of the street and opposite to one another. The standards were encased in 3-in. fibre conduit and laid 18 ins. in the ground, below the sidewalk. Provision has already been made for another fifty of these lamps, which will be added during the coming summer. Approximately 15,000 ft. of conduit has been laid altogether.

These lamps are operated by a mercury arc rectifier and constant current transformer. The rectifier changes the current from 2,200 volts a.c. to 6.6 ampere d.c.

This lamp is claimed by the manufacturers to have an efficiency of 2.11 mean hemispherical c.p. per watt. The maximum intensity is given at an angle of between 5 and 10 degrees below the horizontal, an almost ideal distribution for street illumination. The design of the lamp is such, also, that a good deal of illumination is given off in the upper hemisphere, thus lighting the fronts of the buildings along the streets better than other lamps will do. The upper electrode used with these units has a life of from 3,000 to 4,000 hours and so requires renewals only about once a year. The lower electrode has a life of 125 hours. These lamps are so designed that at any time an electrode of higher efficiency

6.6 amp. luminous arc on cast iron standard, Sudbury.

may be installed, which, it is claimed, will increase the illumination by 25 to 30 per cent. without any increase in current consumption.

The system was laid out and installed under the eye of the electrical superintendent of the town of Sudbury, Mr. R. H. Martindale, who is to be congratulated on an excellent piece of work, and an illumination effect which must be gratifying to the citizens. The equipment was supplied throughout by the Canadian General Electric Company. One of the standards is illustrated herewith.

Operating Record of an Electric Truck

An example of the successful operation of electric trucks in heavy hauling is given by the Electric Vehicle Association of America from the report of the Chief of Transportation of the Philadelphia Electric Company showing in very significant figures the record of a truck employed in transporting telephone poles. On December 23 this truck hauled 5 heavy 45-ft. poles for the Bell Telephone Company from the Philadelphia Electric Company's pole yard at 17th and Ledgeley Avenue to Newton Square, Pa. "There is nothing remarkable," reads the Chief's report, "in the statement as it stands, as we have made this trip frequently of late, but significance does lie in the fact that the trip was made by our Number 44 electric truck in the good time of 6¾ hours—leaving the pole yard at 6.30 a.m. and arriving at Newton Square at 11.30 a.m. and arriving back at 1.15 p.m. after leaving Newton at 11.45, making the total time for the round

trip 6¾ hours and using 305 ampere hours. The poles hauled were above the average size, the entire load approximately 8 tons, the capacity of the truck being 6 tons. This fact, together with the hilly country travelled, caused the truck to use in some places three times the amount of current ordinarily required. This was particularly noticeable in the run from 63rd and Market Streets, to Llanerch, a distance of a little over two miles, taking one hour's time and using 55 ampere hours. "In addition to the above," continues the report, "I desire to call your attention to the difference in the cost of hauling these poles by horse team. The cost of the trip made by Number 44 truck was 6¾ hours at $1.50 per hour, or $10.12. The horse team took 20 hours at $1.20 per hour or $24.00. Thus you will see that it cost approximately $14.00 more to haul by team than by electricity.

Cables of Record Length

The accompanying cut shows cables supplied and installed by the Canadian British Insulated Company, Limited, Montreal, and manufactured for them by the British Insulated & Helsby Cables, Limited, Prescot, England. The particulars of the cable are: Two lengths 1/0 B & S gauge, three conductor, for 25,000 volt service, each in one length of 2,104 feet. They were paper insulated, lead covered and armoured with two layers of galvanized steel wires; diameter over insulation 2.225 ins.; thickness of lead .150 ins.; diameter of armoured wires .128 ins.; test pressure 50,000 volts.

The operation of lead covering each of the lengths lasted for six hours, continuous working, the quantity of lead used being 5¼ tons (11,760 lbs.). This is a record length for cables of this diameter. The gross weights of the two drums were 37,492 lbs. and 37,408 lbs. respectively. They were 9 ft. 7 ins. in diameter, and were thus the largest, though not the heaviest, hitherto exported by this firm. After being landed

Laying cable across Ottawa river at Hawkesbury.

on the quay at Montreal the cables were loaded on a scow and towed to Calumet, from which point they were laid across the Ottawa River to Hawkesbury. The cables were fixed to wood poles into end bells of the Prescot inverted type, with leads to overhead lines. The cables were built to specifications drawn up by Dr. L. A. Herdt, the consulting engineer, and are used in connection with a plan for developing 10,000 h.p. at Bell's Falls on the Rouge River, P.Q., for T. Ross and Sons, Hawkesbury.

The Geo. T. Elder Milling Company, Elder's Mills, near Brampton, Ont., are installing electric service for light and power.

Underground Conduit Work

(Continued from page 37)

manhole. An interior cover pressing upon a rubber gasket was intended as a waterproof seal. Experience has shown that this costs more than it is desirable to spend for any advantage that would result, and it is better to furnish each manhole with a single cover and if possible connect the bottom of the vault with a drain leading to the sewer so that any surface water that enters is drained away.

The idea of the watertight cover probably arose in an attempt to make conduits gas-tight. In early conduit days much alarm was created by terrifying explosions in manholes. The illuminating gas, leaking from the pipes of the gas companies, was apt to collect in the ducts, and sooner or later to find its way to a vault, sometimes mixing there with air in explosive proportions, then an ignited cigar or spark from a horse's hoof would ignite the mixture. To obviate this difficulty the plan was adopted of sealing manhole covers and of installing a ventilating plant that should force compressed air through the conduits to blow out the dangerous gaseous mixture. Such a plan is expensive to install and more expensive to maintain and it has been found under normal circumstances that if care and attention is given to designing conduits so that they will always slope towards the manholes, and if the manhole covers are properly provided with ventilating apertures of sufficient size and the floors with drains to the sewers, there is little to be feared either from accumulation of explosive gaseous mixture or too great a collection of surface water.

For the prevention of accidents it is wisdom from the moment the street is opened until the re-surfacing to take all possible precautions, and the following are points to be observed,—provide suitable barricades and place sufficient number of lamps at night in order to show all piles and materials in the street and the trench.

Personals

Mr. C. Blackhall, Wingham, has been appointed superintendent of the Acton hydro-electric system.

Mr. M. S. Woollard has been appointed to take charge of the installation and operation of the electrical plant of the Ontario Stone Corporation, in the company's quarries at Uthoff, Ont.

Mr. R. D. Johnson, hydraulic engineer with the Ontario Power Company at Niagara Falls, has resigned that position and opened a consulting engineering office at 60 Wall Street, New York City.

Mr. C. W. Colvin has been appointed transmission engineer of the British Columbia Electric Railway Company, and is now in charge of the high tension lines and telephone system of the company.

Mr. B. Elshoff has recently resigned his position as superintendent of the electrical department of the Canadian Westinghouse Company, Hamilton, Ont., to become works manager of the Diehl Manufacturing Company, Elizabeth, N.J.

Mr. W. L. Brown, representing British interests, is active in connection with the continuation of construction work on the Ottawa and St. Lawrence Electric Railway, some 30 miles of which have been graded in the neighborhood of Metcalfe

Mr. R. A. Sara, sales manager of the Winnipeg City Light and Power Department, has returned to the city after spending about two weeks in the East on a combined holiday and business trip. Mr. Sara visited Toronto, Montreal, Detroit, Chicago and Minneapolis, where he investigated the accounting systems in use by the power companies with a view to improving, if possible, the system in use by the City of Winnipeg.

What is New in Electrical Equipment

New Trumbull Push Switches

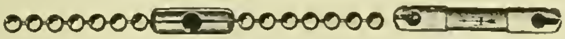
The Trumbull Electric Manufacturing Company are putting a new push switch on the market which they have been working on for the past three years. This switch has been passed by the underwriters and is claimed by the manufacturer to have a remarkable electrical strength—having with-

Trumbull Push Switch.

stood an overload greater than any other switch on the market. The switch is very smooth and easy in action, very neat in appearance and is manufactured from fewer parts than many other switches, which tends to lessen friction and concentrate strength where it is most needed.

New Arrow Electric Devices

A new detachable insulator and a splicing link for pull socket chain are shown in the accompanying illustrations. Both are made on the same principle and may be instantly attached or detached. With the insulator or splicing link at-



Insulator and splicing link.

tached the chain hangs perfectly straight. These devices are manufactured by the Arrow Electric Company, Hartford, Conn.

Installing Meters in Outer Walls

Meters are often installed in almost inaccessible rooms and closets, to reach which requires not only entrance to a private residence, but also climbing of flights of stairs, dirtying floors, disturbance of occupants, etc. Even when meters are installed in the basement, as is generally the case in the

Meter box closed—and open.

modern home, much time is wasted by the meter reader in waiting at the door and getting access to the instrument. If these delays could be done away with and the little antagonisms that often arise in this way between the company and the householder could be dispensed with, the central station would find itself in a much more favorable position to do business with its customers.

What appears to be a happy solution of these troubles is the insertion of the meter in one of the outer walls of the house and protecting it from the weather and from interference, at the same time making it possible for the meter man to take his readings without waste of time or disturbance of the occupants of the house. Such a device as this is now placed on the market by the Donley Bros. Company, of Cleveland, Ohio. The device consists of a special metallic meter casing and service switch. This casing or box is built right into the wall, just as a window casing would be. The general appearance of the box itself, both closed and open, and of the small and inconspicuous wall opening behind which it is recessed, are shown in the accompanying illustrations.

The box is made of good quality iron and is strongly built. Its outside dimensions for a.c. meters are 14.5 ins.

Meter reader does not enter house.

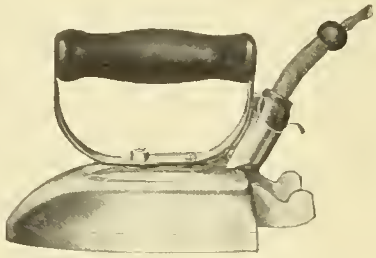
wide, 7.25 deep and 10.25 high; for d.c. meters, the height is a little over 17 ins. The installation can of course be made in any kind of wall. A strong hinged front door, with lock, gives access to the meter for installation or testing, and to the service switch in emergency. The glass window in the door permits reading the meter without opening the door. Since the meter box can be set into the wall and is locked, sufficient protection is provided against storm or tampering.

Provision is made for the service wires in the upper right-hand corner of the box, as shown in the open view, and the house wires pass out below the meter as shown. If the service wires are brought down in conduit outside of the house right to the meter box, the central station company can pass them through either of two knock-outs in the upper corner of the box front. This is a very convenient arrangement where old houses are to be connected up for service. Fastened to the back iron wall of the box is a wood board to facilitate mounting of the meter and switch service.

The annual general meeting of the Shawinigan Water & Power Company will be held at the head office of the company, Power Building, Montreal, February 16.

The Pelouze "Ideal"

A new sadiron, the "Ideal," is now being marketed by the Pelouze Manufacturing Company, Chicago. This is described by the manufacturer as "a good iron at a very low price." It is furnished with the patented "quick break" switch plug; when at rest, the iron is simply tipped back on

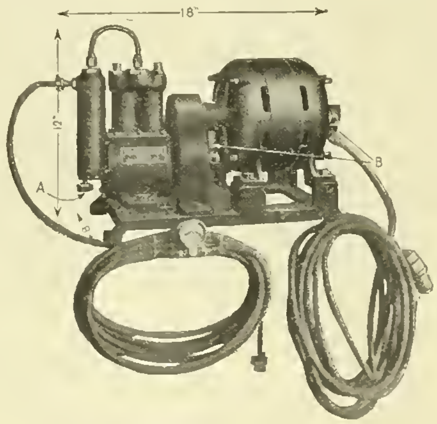


Iron tips back on stand.

end and does not require an extra stand, as with other irons. This iron is claimed to heat at an unusual speed, and to have an extra large storage capacity. The consumption is 500 watts; finished in either satin or bright nickel.

"Master" Portable Garage Pump

The cut herewith represents model G "Master" portable garage pump manufactured by the Hartford Machine Screw Company, and distributed in Canada by R. E. T. Pringle, Toronto. This pump is designed for use in public garages, where the demand is for a tire pump of unlimited service capacity. It is claimed to have great power and durability and to be constructed according to the best mechanical

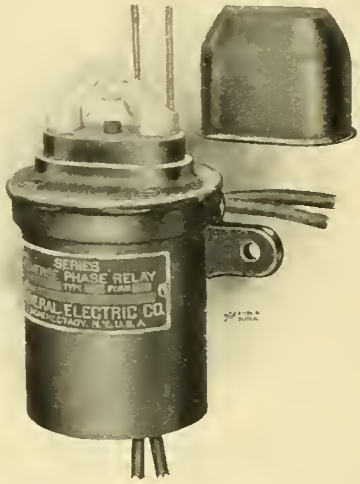


Portable garage pump.

principles and with the utmost care in every detail of manufacture. The pump of this outfit, when running at the normal speed of 500 r.p.m., will deliver 3 cu. ft. of free air per minute. The driving motor, designed specially for this machine, is one-half h.p. capacity.

A Reverse Phase Relay

In order to protect alternating current motors against reversal of phase the Canadian General Electric Company have brought out a reverse phase relay which will instantly open the lines. A reversal of phase may occur in the source of supply or because of reversal of the leads of the motors themselves, something which is liable to happen at any time when they are connected up after repair. This is true as regards any type of machine run by a.c. motors, but particularly in elevator service. The reverse phase relay, here shown, is of great value where used to prevent unintentional reversal of direction of an elevator carriage caused by an error in connecting the leads on the elevator motors, or in the service mains. Phase reversal will instantly open the lines and protect the machinery against reversal of desired direction of movement. The reverse phase relays are used in connection with shunt trip or low-voltage coils on oil switches or circuit breakers. They are simple and substantial and in design based on the principle of the induction motor. In case of motors of limited capacity, the relays may be connected in series with the motor leads. If the

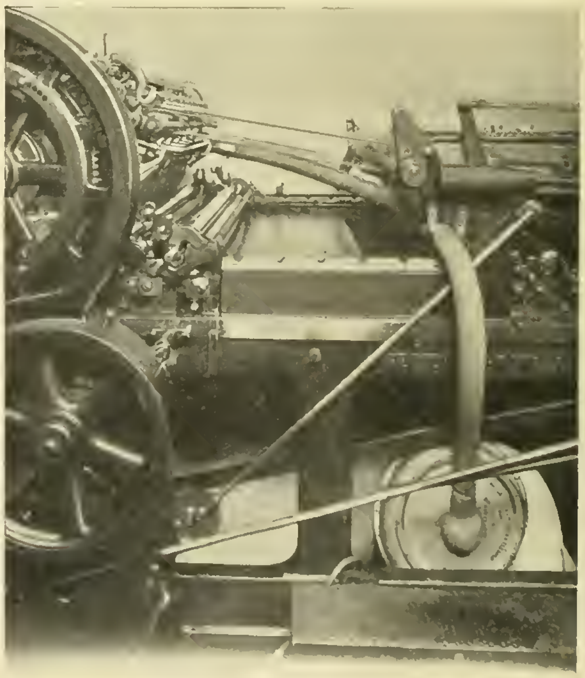


Reverse phase relay for motor protection.

voltage or capacity of the motor makes this arrangement inexpedient, the relays may be placed in the secondaries of current or potential transformers connected in the motor leads.

Electric-Driven Vacuum Sheet Cleaner for Cylinder Presses

The illustration herewith shows a vacuum cleaning outfit for use on any cylinder printing, lithograph or offset press. The outfit consists of a series of vacuum cleaning nozzles that are connected to a series of manifolds. These are graduated in size to insure uniform velocity of suction at all points. A hose is attached to these manifolds which runs out and



Vacuum cleaner for press cylinder.

down alongside the press to a motor driven suction fan which can be installed either under the press or off to one side. The series of nozzles extends the full length of the cylinders and are placed in such a position and at such an angle that,

as the paper leaves the press the air suction plays continually on the surface and edges, and removes all the loose dirt and foreign matter. On second revolution of the press all the dirt left from the under side of the sheet is collected before it has a chance to reach the forms, and in this way the forms are kept perfectly clean, insuring clean inking rolls and clean ink in the reservoirs. The motor used with the blower is a one h.p., d.c., high speed, 110 or 220 volt manufactured by The Robbins & Myers Company, Springfield, Ohio. The outfit is manufactured by Britton & Doyle, Cleveland, Ohio.

New Pendant Fixture for Station Lighting

With the recent introduction of the new gas filled mazdas, which have an intensely brilliant filament and which also require special ventilation, it has been found necessary to design a complete new line of lighting fixtures to accomdate these lamps.

A new fixture recently placed on the market by the Benjamin Electric Manufacturing Company of Canada, Limited, Toronto, as shown in the accompanying illustration, has been designed for special use in lighting large areas indoors, such as in railway stations, offices, etc.

Benjamin fixture for Type C Mazdas.

The fixture is built along plain but ornamental lines and consists of a 6-in. x 8-in. stalactite globe which, with the ventilating hood, is supported by a link chain with swivel at the top. A hole in the bottom of the globe provides both an entrance for the flow of ventilating air currents and also an exit for dirt, dead bugs, etc., which usually collect in lamp globes. It should be noted that the taper of the globe is steep enough so that the dirt will slide out of its own accord.

The fixture is designed for type "C" mazdas ranging from 200 to 300 watts and has provision in the hood for ample ventilation. This unit measures 27 ins. overall and is a valuable addition to the list of ornamental fixtures which has recently been designed for this new high candle power lamp.

Anti-sulphuric Enamel

Messrs. Griffiths Bros. & Company, the well-known English manufacturers of paints and varnishes, have recently closed a contract with the Admiralty for a supply of two thousand gallons of their famous Anti-sulphuric Enamel. This enamel, which as its name implies, affords protection against the deleterious action of acid fumes, is stocked in Canada by Spielmann Agencies, Montreal, who have supplied large quantities to the leading railroads, electrical plants, laboratories, etc

Trade Publications

Ironclad-Exide Battery—Bulletin No. 146, distributed by the Canadian General Electric Company, describing the Ironclad-Exide Battery for storage battery locomotives. Well illustrated and contains much interesting information regarding the treatment and capacity of this type of battery.

High-Tension Equipment—The Delta-Star Electric Company, Chicago, Ill., are distributing Bulletin No. 15 devoted to high-tension indoor equipment. This bulletin, which comprises 80 pages, has a total of 188 illustrations, and lists approximately 1,200 different types of switches, fuse mountings, choke coils, etc. Ten pages are devoted to technical data of interest to engineers.

Current News and Notes

Brantford, Ont.

The results of the improvements in the rolling stock and road bed of this system are already making themselves shown. For the week ending January 9th, 1915, the returns were $839.19, as compared with $685.13 for the corresponding week a year ago.

Chatham, Ont.

The Chatham Public Utilities Commission have rented suitable premises and will immediately open a demonstration department to educate citizens in the uses of the various electrical devices.

Hamilton, Ont.

The Bell Telephone Company have increased the price of telephones to Hamilton schools from $25 to $45 per year. There has been an agitation in Hamilton for some time regarding the installation of a municipal telephone system and this last move of the company has not tended to allay the feeling of opposition.

London, Ont.

The London and Port Stanley Railway Company have placed an order with the Preston Car & Coach Company for three trailers, one baggage and one freight car. The trucks for these cars are being built by the Baldwin Locomotive Company.

Montreal, Que.

The Law Department of the Montreal Council has reported that the Electrical Commission cannot be forced to put fair wage clauses in contracts accorded for underground conduits for wires, but that the city can ask them to do so. Tenders are asked for by the city, but the commission let the contracts. If made necessary by the Public Utilities Commission, the contractors will have to pay "fair wages."

Mr. J. E. Thibault, of Bagotville, P.Q., has drawn plans for a public and private electric lighting scheme at Roberval, P.Q. It is proposed to develop a water power three miles from the town, and install the necessary turbine and other machinery to give 600 horse-power.

Newmarket, Ont.

It is expected that a by-law will be submitted to the electors in the near future, authorizing the council to enter into an agreement with the Toronto and York Radial Railway Company for a supply of electric power. Two by-laws have been submitted in the recent past, asking authority to close with the Hydro-electric Power Commission of Ontario, but these by-laws were both defeated by heavy majorities. About $15,000 would be required to meet the expenses of the necessary distribution system..

Newcastle, N.B.

The new wireless station of the Universal Radio Syndicate at Newcastle, N.B., is now complete. The Syndicate has a contract with the Canadian Government to transmit government and commercial messages from Canada to the United Kingdom. A clause in the contract provides that the government shall have the right to take over the station after five years, at a price to be fixed by the Railway Commission. The Newcastle station communicates with a similar one at Ballybunion, Ireland.

Ottawa, Ont.

The Porcupine Power Company, Limited, has surrendered its charter.

St. John, N.B.

The estimated expenditures for the lighting department for the coming year amount to $35,102. This includes the installation of 50 new lights at a total cost of $3,700. The number of street lights in the different portions of the city now total 358 arc lamps, and 72 100-watt tungstens.

Peterborough, Ont.

Wm. Kennedy, Jr., Montreal, has submitted a report dealing with the proposed auxiliary plant for the water works system. Mr. Kennedy gives estimates on six different types of unit as follows:—(1) turbine pump driven by motor; (2) turbine pump driven by steam turbine; (3) pump driven by both steam turbine and motor; (4) pump driven by reciprocating high speed steam engine; (5) pump driven by gas engine; (6) pump driven by gasoline engine. Either No. 2 or No. 6 are recommended, final choice to be made after the tenders are considered.

Toronto, Ont.

The Parks Committee have approved of the Commissioner's recommendation to change present lighting system on University Avenue to an overhanging lamp on iron standards.

The Electric Furnace Products Company of Canada, which is associated with the Union Carbide Company, is reported to have secured a concession from the Norwegian Government and have made arrangements for the construction of a hydro-electric plant at Saude on the southwest coast of Norway.

Satisfactory progress is being made by the Hydro Commission in installing power services in Swansea and Runnymede.

Notice has been given that the Eastern Ontario Electric Railway Company will make application to the Legislative Assembly of the province of Ontario for a further extension of time in which to commence and complete the railway which this company is authorized to construct.

Tichborne, Ont.

Fream Bros. are seeking information as to cost and construction of a small hydro-electric plant on Eagle Creek, principally for the lighting of their own works there, and the village of Tichborne Junction about a mile distant.

Victoria, B.C.

City Electrician Hutchison is making tests on nitrogen-filled tungstens, with a view to installing a number for street lighting.

Westmount, Que.

The annual statement shows that the Municipal Lighting System of Westmount yielded net profits of $30,400 in 1914.

Winnipeg, Man.

The City of Winnipeg will receive $122,227 as its share of the 1914 profits of the Winnipeg Electric Railway Company.

Private A. Ross of the Princess Patricias, reported wounded in action, was a conductor in the employ of the Winnipeg Electric Railway Company.

The Electrical Section of the Canadian Society of Civil Engineers has been holding well attended fortnightly meetings during the winter in the lecture hall of the Manitoba University, at which a number of very interesting and instructive papers have been presented. At the last meeting on January 18th, a paper was read by Mr. Leonard Andrews on "Automatic Lighting Plants."

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Generation, Transmission and Application of Electricity

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A Continental Electric Demonstration

A number of manufacturers, central station men, jobbers, contractors and dealers recently met together in New York City at the call of J. M. Wakeman, general manager, Society for Electrical Development, to discuss the advisability of a continent-wide electrical celebration during a whole week this coming autumn. The Electrical World reports that the meeting decided to recommend to the board of directors of the society the inauguration of a vigorous sales and educational campaign during the week of October 18, 1915. The plan contemplates the co-operation of all affiliated interests in the electrical industry with national manufacturers and with civic bodies to promote the better lighting of streets, stores, factories, schools and homes, all with the aim to show how general business in each community may be advanced by the larger use of electricity in all its applications.

Among the suggestions made as to the best means of promoting the plan was the enlistment of the co-operation of the Jovian Order and other electrical societies and associations, and of national advertisers who might use their space in magazines to arouse the interest of the public and to get their customers to make special window displays during electrical week; the co-operation of mayors and other functionaries of towns and cities; the co-operation of boards of trade, chambers of commerce and like civic organizations; the inauguration of "white way" lighting and similar attractions to bring people into the cities; a campaign on the part of electrical contractors to encourage all merchants to increase greatly their window illumination and display during the week; activities on the part of central stations in the way of offering prizes for the best lighted stores, best display of electrical merchandise, best illumination of display of other merchandise, as well as liberal advertising campaigns in local newspapers prior to and during the electrical week; parades of electric vehicles, floats, etc. It was suggested also that the society prepare special posters for bill board and other use to be sold at cost to those desiring to use them in advertising the carnival, prepare special literature for distribution by central stations, supply dealers, contractors and others, arrange for lectures, special meetings, articles in trade papers, newspapers, popular magazines, etc.

If the board accepts the suggestion, a special committee will probably be appointed to take charge of the work under the direction of the general manager of the society, sub-committees and local committees all over the United States and Canada taking charge of the details.

Operation Cost of Diesel Plant

The town of Yorkton, Sask., claims the distinction of having installed the first Diesel oil electric unit in Canada. This was in 1910, and since that time considerable interest has attached to the operation of this and other plants since installed, and operating figures have been carefully watched with a view to comparing the advantages of the Diesel plant with the advantages of the steam engine or other type of prime mover. Yorkton has evidently found the Diesel plant satisfactory, as they have just completed the installation of a second unit of 500 h.p. capacity. We are pleased to be able to reproduce a description of this plant on other pages of this issue, and to append also some definite figures regarding the cost of installation and of the operation of this new unit, together with some operating figures on the first unit installed.

The important factor about the operation of this plant would appear to be that the actual figures for fuel and oil consumption are well within the guarantees given by the manufacturers. The amount of fuel oil consumed per unit generated is practically the same for the two years, being .11 gallon per unit in 1913, and .115 gallon per unit in 1914. Fuel oil f.o.b. Yorkton has varied from $10\frac{3}{4}$ to $12\frac{1}{4}$ cents, or on the average, $11\frac{1}{2}$ cents. Therefore, the cost per unit generated on the average has been .1125 by $11\frac{1}{2}$, equals 1.294 cents per kw.h.

It would be interesting to know what the complete overhead expenses have amounted to during the operation of this plant, but these figures are not available. The plant is operated, according to our information, about nineteen hours per day, which presumably is taken care of by two shifts of one man each. Neither have we figures which would enable us to estimate the overhead charges of the plant itself, but from now on there will be interest and depreciation on the investment in the new plant and its contents, which is slightly less than $100,000. This will mean, according to usual allowances, approximately an extra annual charge of $15,000, which, together with the charges of two men at, say, $1,000 apiece, would bring the evident overhead to $17,000 and with incidentals, perhaps $18,000. The total number of units generated in 1914 was 262,802, and supposing that this amount is not exceeded in 1915, and that the charges are as above stated, the cost of operation per unit will be $18,000/262,802, equals 6.849 cents per kw.h. This amount, added to the fuel cost of 1.294 brings the total cost of operation to 8.143 cents per kw.h. This figure should represent approximately at least the cost of producing power in the Yorkton plant.

The Yorkton plant has been built with an eye to the future, however. The power house will accommodate three

more 500 h.p. units and foundations for two of these have already been placed. Auxiliary equipments also, sufficient for a much larger plant, are included in the capital expenditure. These conditions considered, it is evident that the Yorkton plant will, under more favorable conditions, and operating more nearly at its fullest capacity, be able to turn out energy at a price which will compare very favorably with many larger plants.

Conversation at 3,400 Miles

"Mr. Watson, come here I want you."

These words, commonplace enough, were the first ever spoken over a telephone wire. Alexander Graham Bell was the speaker, and Thomas A. Watson his mechanical assistant who built the first telephone instrument, the hearer. That was on June 2, 1876.

Perhaps if Bell could have known the historic interest that would forever attach to this first utterance, he would have been more careful with it—he might have thought out something more impressive—something breathing awe and wonder. But he didn't think of it soon enough and "Mr. Watson, come here I want you" goes marching down the ages wearing a halo that somehow doesn't quite fit. Yet, for all that, it is historic, and it will stick.

On Monday, January 25th, when Dr. Bell spoke from New York across the continent to this same Thomas A. Watson in San Francisco, 3,400 miles away, those sitting near Bell saw a twinkle in his eyes. Once again he spoke the historic words of 39 years ago—"Mr. Watson, come here I want you."

Watson recognized the words instantly and quick as a flash came back his answer—"I'll come Dr. Bell, but it will take a week this time."

Could anything better illustrate the progress the telephone has made than this interesting little colloquy.

At the celebration referred to, one of the most remarkable features was the talk Dr. Bell and Mr. Watson carried on with Bell using an exact replica of his first telephone instrument—simply a piece of skin, an animal membrane, stretched over a piece of wood and in touch with a magnet. Watson 3,400 miles away heard him, as he said, "perfectly."

Think what this means. The instrument through which only a little over three decades ago Bell could speak so as to be heard only a few feet, now transmits his voice across the continent—over mountain and valley, desert and plain.

How account for the improvement? What has intervened to make the difference? Is it some lucky device, some twist given a wire or a spring by a fortunate inventor?

The question was asked of Mr. John J. Carty, chief engineer of the American Telephone & Telegraph Company to whom belongs much of the credit for this marvellous achievement.

"What has intervened," said Mr. Carty, "is the entire art of telephony. No single device nor invention has made transcontinental speech possible, as we have it to-day. Rather, it has been the cumulative effect of improvements great and small in telephone transmitter, line, cable, switchboard and every other piece of apparatus or plant required in the transmission of speech What has intervened has been this company and all it stands for, its experimental and research department of 550 engineers and scientists including former professors, post-graduate students, scientific investigators—the graduates of over 140 universities. The results achieved represent vast expenditures of money and immense concentration of effort which have been justified by results of immeasurable benefit to the public. No local organization unaided could bear the financial or scientific burden of this work. Such results are possible only through a centralized staff avoiding wasteful duplication of effort, working out problems common to all for the benefit of all."

"We will have to guard against the idea that now the job is done. I see plenty of development ahead for another generation of telephone men when all of us are gone. I could lay out now in a general way work which they must do, and which I know they will do. We have not accomplished it all—we have an immense amount yet to do. We can never again make a contribution like Bell's first telephone, but the things that are ahead of us are surprising and startling; they are as important as anything we have yet done. We should kill the idea that now the thing is done and there is nothing else to do. We are only beginning."

And yet there have been few more dramatic moments in the history of science than when the venerable Professor Bell lifted the receiver from its hook and called to Watson, the friend and fellow-workman of his youth, in far away San Francisco. There was a wonderful story in that first "Hello," a marvellous tale of miracle-working, of heroic struggle and sublime achievement. Few men have seen so great a dream come true. Probably no two men before, in all the history of the world's discoveries and inventions ever lived to see such magnificent results from work in which they had been the pioneers.

Public Utilities and the Public

At the last convention of the American Electric Railway Association, a Code of Principles was drawn up and adopted, which outlined in a comprehensive way what the Association considered the ideal relationship between public utilities in general and the public. The midwinter meeting of the same association has, in effect, reiterated its belief in its code, and the matter was further dealt with in a paper prepared by Col. T. S. Williams, president of the Brooklyn Rapid Transit Company. This paper is presented elsewhere in this issue.

Briefly stated, the code emphasizes the necessity of public utilities getting closer to the general public, with a view to better mutual understanding. Many of the troubles of the present day arise through companies being unable to control circumstances which are evident enough to themselves, but are not appreciated by their customers. Many of our utilities to-day are giving what amounts to practically an ideal service, but, in far too many cases, the public either cannot or will not see these facts, because of certain antagonistic feelings, which are the result of past relationships between the public and the corporation. Not only is this the case, but the sincere efforts of many a corporation have been rendered less fruitful and, in certain cases, entirely so, by the lack of co-operation of the people they serve.

It is all very well to say that the companies have only themselves to thank for the present conditions, but in the meantime it is the public that suffers quite as much as the companies. There is no doubt, however, that the vast majority of public utilities have come to see the futility of disregarding the wishes of the people they serve, and are now adopting a much more conciliatory policy than was dreamed of ten years ago. This is the natural development of modern business life, where it has now been proven beyond question that tact, conciliation and, in short, the treatment of a customer like a human being, will give entirely the best results. The difficulty lies, however, right here. The public do not appreciate the change of heart of the corporations, and having been brought up to believe that antagonism was the natural and proper feeling between utilities and the public, and not having been educated to think differently, they are still in the habit of deriding any attempt on the part of the corporation to treat them with consideration. This, we believe, is at the root of much of the present trouble, and it is just this condition which the Code of Principles has been developed to consider and remedy. Under the code not only are the railway companies enjoined to use every reasonable

means to ensure the convenience and comfort of their patrons, but they are also expected to educate the public to look for these things and, at a little later date, to appreciate them, and, as a result, co-operate. We believe there are signs in certain quarters that results are already being shown, though the process of education has not been carried forward to any appreciable extent. Col. Williams' exposition of this Code of Principles and his evident well-grounded belief in the results that may be obtained, are of timely interest. The present is a time when nothing but the closest co-operation can give satisfactory results in our industrial and commercial life. With the war abroad, there is all the more reason why there should be none at home. Most misunderstandings are the result of lack of intelligent information on the part of one or both of the parties concerned. If the general public can be brought to appreciate a few of the almost insurmountable difficulties under which our growing public utilities operate, and if the utilities themselves can forget their worries long enough to look at the situation with the eye of the private individual, the causes of most of our misunderstandings may be removed, to the common profit of all concerned.

International Engineering Congress

The technical success of the International Engineering Congress is now well assured. Notwithstanding the difficulties arising as a result of the present European war, the Committee on Papers is able to count on from 200 to 250 papers and reports covering all phases of engineering work and contributed by authors representing some 18 different countries. The Congress will therefore be truly international in scope and character, although the representation from the countries involved in the European war will naturally be less than originally planned.

The papers are now rapidly coming in and their character gives the fullest assurance that the proceedings will form a most important collection of engineering data and a broad and detailed review of the progress of engineering art during the past decade.

The Committee of Management is now issuing to all important engineering societies, in this country and abroad, invitations to appoint official delegates to attend the sessions of the Congress, and the presence of a considerable body of such delegates is well assured.

Membership in the Congress with the privilege of purchasing any or all of the volumes of the proceedings is open to all interested in engineering work. For full particulars apply to W. A. Cattell, Secretary, 417 Foxcroft Building, San Francisco, California.

N. E. L. A. Midsummer Convention

The Annual Convention of the National Electric Light Association, to be held at San Francisco, Cal., June 7, 8, 9, 10, 11, 1915, will probably be one of the most interesting ever held on account of there being the great additional attraction of the Panama-Pacific Exposition at the same time. With this in mind, the Transportation Committee of the N. E. L. A. is arranging for the train movements of the members to the Pacific Coast in such a manner as to give them an opportunity to visit en route, both going and returning, nearly all the points of scenic grandeur in the western country and at the same time to make as many stops at the various large hydro-electric and transmission systems as possible. It is believed that the central station member companies will send more of their engineering and operating officials than would be the case should the tours not possess these features. It is proposed to arrange for four or five tours, most of them being complete circular tours going to the Convention, and, after a week's stay at San Francisco, returning intact by various scenic routes. The trips will be on the "all expense plan," which will include, excepting the stay in San Francisco, the entire expenses as outlined by the different itineraries soon to be issued.

New House Wiring Plan in Brooklyn, N.Y.

The current issue of the N. E. L. A. Bulletin describes the "New House-Wiring Plan" of the Edison Electric Illuminating Company of Brooklyn, N.Y., which went into effect about two months ago and is proving successful, in spite of the present rather unsatisfactory business conditions. It is believed to be, by many who have given the subject much attention, the best of its kind yet devised. It possesses two "human nature" features: First, that any householder may himself ascertain, with five minutes' computation, just how much it will cost him to wire his home or any part of it; second, the plan provides for easy payments and long credit, the minimum monthly installment being $2, and the maximum period 20 months.

The plan supplies flat rates for wiring and fixtures for each room of any house; for instance, in the kitchen $19.45 buys an outlet, consisting of a baseboard or wall flush receptacle, and one ceiling outlet, with a one-light fixture and pull-chain socket; $11.75 buys a dining-room outlet, with a three-light shower fixture. If an amber-glass dome is desired instead of the shower, the price is $1.50 more. In the bathroom, a one-light, nickel-plated fixture, with pull-chain socket, costs $6.20.

The plan provides in great detail definite prices for every feature of equipment. Flush wall switches, for instance, are $3.85 each. Two three-way switches for controlling hall light from upper or lower floor are charged for at $9.90. Prices are given for street floor; and for each additional floor above this, $5.50 is added to pay for risers.

The fixtures that go with this plan are shown in attractive literature, and samples may be seen at any office of the company. If customer does not care for these standard fixtures and desires a personal selection, the price on each fixture, as set forth, may be deducted from the flat charge.

It will thus be seen that there is no longer any necessity for getting an estimate from one or more contractors, but the estimate may be given immediately for any or all house wiring.

As already stated, the payment plan is very liberal; for instance, one may obtain $50 worth of wiring equipment for a payment of $5.00 down and $3.00 per month.

The actual house-wiring work is done exclusively by contractors. In fact, the prices are based on figures given by the contractors themselves. Prior to adopting the plan, the company obtained estimates on specifications covering the work required from six of the best contractors in the city. They were given to understand that these estimates covered a blanket situation, and that the contractors would be asked to take the fat with the lean. When these figures were received the lowest was not adopted, but an average was struck, and the amended figures were submitted to every responsible contractor in Brooklyn for acceptance, if desired. A great majority of the contractors accepted the offer to do work at the prices stated, and the contracts obtained by the company are now being widely distributed.

The fixtures are purchased by the company in large lots at low prices, and are maintained at several depots throughout the city, where contractors doing house-wiring jobs call and obtain them.

The Department of the Interior of the Dominion of Canada, Irrigation Branch, have just issued a report of "Progress of Stream Measurements" for the calendar year 1913.

Yorkton Adds Another Diesel Unit

First Unit Operating Since 1911 With Entire Satisfaction New Unit 500 B.H.P. Capacity—New Power House Planned for Extensions

To the Town of Yorkton belongs the distinction of having installed the first Diesel electric unit for lighting and power purposes in Canada, at their old power house, towards the latter end of 1910 and the beginning of 1911. This plant consists of 150 B.h.p. Diesel fuel oil engine running at 240 r.p.m. and direct coupled to a 3-phase alternator with belt-driven exciter. Since starting up in 1911 the plant has operated practically 19 hours per day and has given entire satisfaction.

Towards the latter end of 1912 and the beginning of 1913, it was decided, owing to the great demand for lighting and power, to augment this small plant by a further installation. Consequently it was decided to build a power house and plant of the most modern type and at the same time make provision for future growth. With this in view it was decided that the local architects, Messrs. Munro & Mead and the town electrical engineer M. M. Inglis, should carry out the work of designing and supervising the complete installation of both power house and plant. This work has now been carried out to a successful issue and the new plant was placed in operation on 17th October of last year.

This power house is 102 ft. long by 58 ft. wide, the offices and stores taking up 20 ft. of this length. It is of fireproof construction throughout with red tapestry brick and Peerless Indiana limestone facings outside, and pressed buff brick inside, steel sash, red quarry tile floor and reinforced concrete roof carried on I-beam purlins supported by steel roof trusses, an auxiliary roof of lumber with tar and gravel finish having an air space between it and the concrete roof thereby preventing condensation of the concrete. The general contractors for the building were Messrs. Ritchie & Watters, of Portage la Prairie. The installation of the heating and plumbing was carried out by Messrs. Parrott & Byers, Yorkton.

Foundations for two 500 B.h.p. units have already been placed but there is room for two additional foundations, thus making a total station capacity of 4 units.

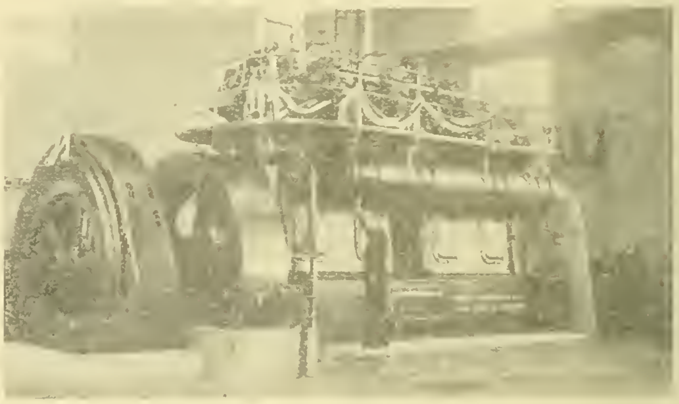
The Diesel Engine

The Diesel engine was built by Messrs. Mirrlees, Bickerton & Day, of Stockport, England, and supplied and erected by their Canadian agents, The Boving Company of Canada, Toronto. The engine has run 20 hours per day since starting up and exhaustive tests have been carried out to verify the fuel consumption and governor regulation guaranteed at all loads from 25 per cent. overload. In no case did the fuel consumption exceed that originally guaranteed by the engine makers. One very important feature is that the engine can be brought from rest up to full speed with full load in about one minute. No boilers are required, therefore no stand-by losses from that source affect the economy of operation.

The engine is of the vertical 4-cylinder totally enclosed forced lubrication type and is capable of developing 500 B.h.p. when running continuously at the normal speed of 200 r.p.m. at sea level. It was guaranteed in addition to this to be capable of carrying 25 per cent. overload for 2 hours without injurious effects. The cylinders are single acting and work on the 4-stroke cycle and the cylinder wall is of tubular construction pressed into the casting which forms the water jacket casing and is held in position as well as the cylinder head by studs. The valves are opened and closed by cams and springs respectively. Both the air, exhaust and fuel valve levers are in two parts, to facilitate the examination and replacing, when necessary, of the various valves. In addition the fuel valve spindles are removable for inspection without removing the levers which operate them. The exhaust valve casings are all water-cooled.

The engine is equipped with a forced lubrication system and the oil which is all contained in the crank case is pumped after passing through a filter by a valveless pump which is direct connected to the engine crank shaft.

The oil is forced through the main bearings, then through the drilled crank shaft to the crank end and passes up the hollow connecting rod also to the wrist or gudgeon pin. The piston depends on its lubrication from the oil thrown off the crank webs. The lubricating oil pressure can be regulated very finely either by the shifting valve on the suction side of the pump or by the by-pass valve fitted to the outside of the engine main casting. A relief valve is con-



New 500 B.h.p. Diesel unit in Yorkton, Sask.

nected on the delivery side of the lubricating oil pump as a safeguard and is adjusted to approximately 20 pounds pressure which is quite sufficient for satisfactory working.

The fuel pump is such that there is a separate piston to deliver oil to each cylinder, although they have a common suction, with separate and distinct suction valves. These suction valves are adjustable and one cylinder can be cut out if so desired when the load permits, by opening up a by-pass valve between the two delivery valves of that pump which supplies that particular cylinder.

The governor, which is mounted on a vertical shaft, controls the speed of the engine by timing the closing of the suction valves of the fuel pump so that the actual quantity of fuel delivered to the cylinder is sufficient for the load. It is also fitted with an oil dash-pot to ensure good regulation. The fuel oil flows to the engine from two 50-gallon tanks placed above the fuel pump. These tanks in turn are fed by a head tank of 100 gallons capacity, which is mounted on a bracket close to the roof of the engine room and easily accessible by means of a walkway constructed and attached to the truss roof of the engine room.

The fuel oil which is delivered on a spur adjacent to the main building is pumped to two large storage tanks situated in the grounds adjacent to the engine room, by a single acting Paul pump driven through worm gear by a 2 h.p. Westinghouse, 2-phase, 550 volt, 60-cycle motor. The fuel oil is pumped from these storage tanks to the head tank in engine room when required, by the same pump.

An overflow pipe is connected to the head tank in the

engine room and is led back to the storage reservoirs outside the building so that there is no possibility of overflowing the head tanks in the engine room.

Compressed Air Equipment

The compressed air equipment of the Diesel engine is one of the most important features connected with its operation as the use of crude oil in this type of engine depends entirely on air at high pressure being available for spraying the crude oil into the cylinders. The air pressure required for satisfactory operation varies from 520 lbs. to 1,000 lbs. per square inch. This is arranged for by the use of storage receivers and blast bottle of solid drawn steel, working in conjunction with a specially designed air compressor. The compressor is driven by an overhung crank on the end of the main crank shaft. It is of the 2-stage type fitted with silent type renewable disc valves and having inter-coolers to cool the air at each stage of the compression.

Air is delivered to the blast bottle and, when desired, to the storage receivers as well as to the engine from the blast bottle. The receivers being for starting purposes are always kept fully charged to approximately 900 lbs. per square inch. The starting receivers are piped to the starting valves of two cylinders and when the engine has gained sufficient speed by means of the compressed air injected, the fuel oil is then injected and the starting air automatically cut off at the same time. The engine then comes into normal operation as the compression temperature in the cylinders is sufficient to ignite the fuel oil.

Water Cooling Apparatus

The water cooling apparatus for the cylinder water jackets is located outside the main building. It consists of an open reservoir 50 ft. x 35 ft. x 8 ft. deep, constructed of reinforced concrete and waterproofed throughout with "Pudlo" concrete. Provision will be made later for a distributor on the outlet pipe from the engine when the additional units are installed. A 4-in. suction pipe connects the cooling tank to a 3-in. rotary pump. This pump is driven off the main shaft by means of a belt. In addition to the cylinder jackets the exhaust pipes, valves, lubricating oil coolers and air compressor are all cooled by this system and the water is returned to the open reservoir. By this means the same water can be used with very little waste.

Generator

The engine is direct connected to a 400 kv.a. 2,200-volt, 3-phase, 60-cycle generator mounted on a separate bedplate. The generator is excited by an 9.5 kw. 65-volt exciter direct connected to alternator shaft and mounted on extension of generator bedplate. The generator and exciter were manufactured by Messrs. Siemens Bros.' Dynamo Works, Limited, Stafford, England. Tests made after installation proved that the machine was well within the guarantee. The total weight of the engine, generator and exciter is approximately 109 long tons.

Switchboard

The switchboard, supplied by the Canadian Westinghouse Company, of Hamilton, Ontario, consists of 4 blue Vermont marble panels at present, 2 generator panels and 2 series tungsten lighting panels. Each generator panel is arranged so that it contains its own exciter switching equipment together with the necessary instruments, voltmeter plugs, ground detector and synchronizing plugs. In addition to the synchronizing lamps a synchroscope is mounted on top of the switchboard which enables the paralleling of the two machines more accurately than by the older method. Provision has been made for future extensions which are to include a Tirrill regulator and three feeder panels as well as an additional generator panel similar to those already installed.

To facilitate the erection of the plants and repairs when necessary, a 10-ton travelling crane supplied by the Boving Company of Canada, was installed. The span is 56 ft. 5 ins. from centre to centre of long traverse wheels. The bridge consists of two 24-inch Bethlehem steel-beams fastened to channel iron end carriages on which are mounted the necessary steel spur pinions working in spur wheels which are cast in one piece with the travel wheels. All the gears are machine cut. The hoisting gear consists of a standard 10 ton trolley hoist with 2-speed worm gear and is operated by means of chain and cast sprocket wheel. The cross travel is operated by means of chain and cast sprocket wheel operating through machine cut spur gearing to the trolley. The total weight of the crane is about 14,000 lbs. and is hand operated throughout.

A Spencer boiler is installed in the basement of the office and store portion of the building for heating the entire building by steam and provision has been made for approximately 30 tons storage space for pea coal. The steam mains are run overhead with branches dropping therefrom to each radiator mounted on the floor. The wet returns from each radiator enter one return pipe which is run under the engine room floor back to the boiler in the basement. The fuel oil delivery pipes, from the motor driven oil pump to the head tanks in the engine room, are run in the same trench as the wet return steam pipe, in order to take advantage of preheating the fuel oil before being used in the engine.

We reproduce below records of the plant for the year 1914 together with the total results obtained during the year 1913. It will be noticed there are little discrepancies in the

YORKTON DIESEL PLANTS

	150 B. h. p. Unit			500 B. h. p. Unit			
Month	Hours Run	Units at Switchboard	Fuel Oil Gallons	Hours Run	Units at Switchboard	Fuel Oil Gallons	Total Lubricating Oil, Gallons
January	487½	14,436	1395¾				31½
February	521	16,473	1663½				38¼
March	575	20,101	2026¼				20
April	553	17,478	1906½				9
May	557¾	16,776	1875				19
June	522	15,969	1743				2½
July	552	16,397	1807½				27
August	573	18,398	1891¾				8
September	556	19,286	1950¼				25½
				Started up 17th October, 1914			
October	284½	11,888	1127¾	292¼	18,650	2,563	89¼
November	9¼	331	36¼	557	34,260	4,666¾	220⅝
December	232¾	5,599	669¼	510¾	36,760	4,710¾	43½
Totals	5,424¾	173,132	18,092¾	1,360	89,670	11,940½	534

fuel consumption per unit during each month but this is mainly accounted for by the nature of the load factor. Comparing the total consumptions, however, of the past two years they convey a good idea of what the fuel costs amount to. Fuel oil costs, at the present time, delivered f.o.b. Yorkton 10½c. per gallon. The reason why the amount of lubricating oil varies so much every other month is due to the fact that in the small unit, which is of open type construction, the lubricating oil, after passing through the engine is collected in the crank case; the oil is then drawn therefrom and filtered, thus the same oil is used for lubricating purposes over and over again. The actual lubricating oil necessary as stated by the manufacturers of the plant would be in the neighbourhood of 2 per cent., in gallons, of the fuel oil consumption. This figure has not yet been exceeded in the operation of this plant.

The actual cost of the various sections of the plant is given below:—

Power house	$40,000.00
2 Foundations for 500 B.h.p. combined units	3,000.00
Cooling reservoir (capacity 75,000 gallons)	2,600.00
1 500 B.h.p. unit complete (erected)	40,000.00
3 Fuel oil tanks	1,200.00
4 Panel switchboards for the control of 2 units and 2 series tungsten street lighting panels	3,600.00
Steam heating installation including Spencer boiler	3,600.00
Total	$94,000.00

In addition to this there was put in a new street lighting installation costing approximately $12,000.00. The apparent high cost per kv.a. installed is explained by the fact that the power house is large enough to accommodate ultimately four 500 h.p. units in addition to which certain expenditures such as heating plant, etc., will not be duplicated.

Summary of Fuel Costs

	1914	1913
Total hours run	6,784¾	5,616
Total units generated	262,802	175,041
Total fuel oil consumed (gals.)	30,033¼	19,334½
Total lubricating oil used (gals.)	534	282¾
Fuel oil per unit generated (gals.)	.115	.11
Lubricating oil to fuel oil (%)	1.8	1.46

Cost of fuel oil has varied from 12¼ cents to 10.45 cents per gallon delivered f.o.b. Yorkton, Sask., during 1914, the present price being 10.45 cents.

Pushing the Sale of Electric Ranges

The Personal Experience of a Central Station Man in the Sale and Operation of Electric Stoves—Electricity at 4 cents Equals Gas at $1.35

By Mr. F. M. Wilkes

Having decided on what stoves to handle and what size to carry, we are now ready to commence sales. Before starting selling stoves it seemed very simple. All that seemed necessary was to put the stoves on exhibition, explaining through newspapers and by letters to prospects that here at last was a fireless cooker, one that did not take hours and hours to cook, but really, in baking at least, reduced the time of getting a meal at least one-fourth. A campaign of this kind got no results, however. We were then confronted with the fact that this, at least, was not the way to sell stoves, no matter how well it might work when applied to other articles. Of course, it at once occurred to us to put out stoves on demonstration. But here an apparently insurmountable difficulty presented itself. An electric stove, unlike an iron or a vacuum cleaner, cannot be used off the ordinary house service. Indeed, in order to get good results it is necessary not only to have No. 6 secondary line wire from the transformer, but at least No. 8 for the service drop and No. 8 from the service entrance to the stove. This, of course, would mean that to put a stove in a house for demonstration purposes we would have to spend from ten to twenty dollars for material and keep two men busy all day making the installation. Then if, for any reason, the stove should be thrown back on our hands, we would be out the whole cost of the test as the material in the house at least would cost more to remove than it was worth.

Just when despair over the stove question was beginning to loom up, however, the presidentess of one of the local women's clubs came in to see our stoves. She was disgusted with trying to cook on an evil-smelling gasoline stove, and agreed to take one of our stoves provided we would guarantee its cost of operation as against coal or wood. With coal at four dollars per ton it only took a few minutes to figure that we would be safe in making the guarantee in regard to coal, and it seemed pretty safe to gamble that wood would cost pretty much the same as coal, so we made her the proposition that we would install our No. 33 (Hughes) stove for sixty-five dollars, same to be cash, and that we would agree to take this stove back any time within four months should the monthly bill exceed four dollars and fifty cents per month. We made the installation almost a year ago now, and her bill has never gone over four dollars.

Perhaps at this point it may be interesting to some of you to know how we arrived at the cost of coal as against electricity; I will therefore give my reasoning. Taking meal by meal, we have the following:Breakfast—A breakfast consisting of cereal and fruit, coffee, toast, bacon and eggs. With electricity this would take about fifteen minutes and would require not over ¼ kw.hr.; with coal, if a fire is made big enough to make the coffee, it will require not less than fifteen pounds of coal. Luncheon—Steak, one vegetable, salad, coffee, cold bread. Electricity, ¼ kw.hr., coal, fifteen pounds. Dinner—Roast, two or more vegetables, salad, coffee and some sort of dessert. With a roast of, say five or six pounds this will take about one and one-half hours with electricity, and will consume about two kw.hrs.; with coal, it will take about two and a half hours and will take not less than forty pounds of coal.

We have then, for an average day, a cost with electricity of 2½ kw.hr. at four cents, equals 10 cents, while to supply the same food with coal would take seventy pounds of coal, which at four dollars per ton would have cost fourteen cents, or, in other words, electricity at four cents will be as cheap as coal at two dollars eighty-five cents per ton. Similarly, electricity at four cents can be shown to equal artificial gas at one dollar thirty-five cents. This leaves only two forms of cooking which are cheaper than electricity, or enough cheaper to make this a decisive point. They are, first, natural gas, and second, gasoline; and against the latter of these we have the item of danger of explosion, which in most cases can be made to offset the saving. The above figures have so far checked nicely with the operation of the electric stoves which we have out. Of course, where the family is more than five, or where a great deal of fancy cooking is done between meals, the bills for electricity, coal or gas will all be proportionately bigger.

Under this guarantee proposition we then proceeded to work on stove prospects, and by the end of September, 1914,

we had some twenty stoves in use, all giving satisfaction. At that time the equipment of the new Domestic Science department came up before the Board of Education. The board was about evenly divided between coke and gas stoves, without any one but the superintendent of buildings in favor of electricity. We felt that we just had to have this business—but how to get it?

We tried to talk the Domestic Science teacher into recommending electric stoves, but to no avail. Finally we got them to consent to come in and look at our stoves before buying coke or gasoline ranges. The Domestic Science teacher rang up at 2 p.m. one day, and told us that three members of the board, the principal of the schools and herself would be down at 5 o'clock to look at our stoves. We at once got busy and fitted my office up as a dining room by covering the table with a cloth and borrowing the necessary utensils. We then connected up one of our stock stoves which stood out in the display room in front and arranged five chairs in a semi-cirlce about six feet from the stove. The educators came promptly at 5, and at our request were seated around the stove. I explaned to them that we wanted them to see how easy it was for even some second-rate electricians to cook on an electric stove. We then proceeded to cook a dinner, consisting of broiled steak, asparagus on toast, fried corn, Southern style, hot biscuits, mashed potatoes and coffee, all right before their eyes, and, as it were, with our sleeves rolled up so as to show that we had nothing concealed. At ten minutes to six, or just fifty minutes after they had entered and less than forty minutes after I first turned on the current, we served them one of as good meals as they ever sat down to. That night when the stove question was brought up, the board voted unanimously to buy nine electric stoves for the High School. These stoves now pay us from forty to fifty dollars per month revenue.

Soon after this incident we made another advance in selling stoves. It happened that a man wanted some charging cable, "about five hundred feet," he said, and requested us to order it. We did, but before it came he decided that he only needed one hundred feet. We called his attention to the fact that this was "special," but he refused to accept any more than the one hundred feet. Finally, therefore, we gave in, and billing him enough to pay for the entire five hundred feet, shouldered our loss and put the remaining four hundred feet in stock. There it had lain for nearly a year when a bright idea hit us. Why not use this for stove demonstrations? It was No. 8 wire, well enough insulated to be strung over a tree limb around the corner of a house and over the window sill into the kitchen, and could be put up or taken down in less than an hour with scarcely any damage to the wire. We now have by means of this charging cable, a method of installing our No. 17 stove up to our No. 50 stove on trial, with only slightly more cost than that of placing an iron or a vacuum cleaner. What with the High School teaching the girls and young women the electric method of cooking, and with this new advantage in trial offers, I believe we now have surmounted the peak of our difficulties, and should during the next year add greatly to this, the most profitable and desirous of residence loads.

Fourteen Electric Vehicles Make Average Run of Over Hundred Miles

A popular fallacy in regard to the electric automobile is that it is slow of motion and of such limited mileage that it is impracticable for general use. To correct this mistaken idea the Electric Vehicle Association of America gives here one example of the actual running power of the electric in the significant test run made by fourteen electric passenger cars on December 5th from Los Angeles to a neighbouring town and return, a distance of almost a hundred miles on a single charge, during which not so much as a wrench had to be applied to a single car. An electric service truck carrying a 1,500-lb. load accompanied the cars and made the trip without a hitch and with power to spare. This run was made by owners of Beardsley electrics, the Beardsley Company offering a silver medal to any owner who made ninety miles on one charge and a gold medal to any who reached a hundred miles, and it is remarkable to note that no one won the silver medal becaues everyone qualified for the gold! The speedometers were sealed at the start and were not opened until the batteries were exhausted which was at about six o'clock the same evening, when it was found that the cars averaged 100.1 miles each, first place being taken by a car which made 112.1 miles and was driven by a young lady. Several of the drivers were elderly people and some were new to the part as was one young woman who was unfamiliar with the car but who after a fifteen-minute practice joined the party and made a score of 100.1 miles. Some of the records ranged as follows: 106.5, 105.8, 104.1, 103.9, 101, 100.3, which are some of the best ever scored by electric vehicles, but which might have been even better under favorable conditions, for the tour lay through hilly country, over country roads with several heavy grades and the return was made through the city in a hard rain over pavements which were exceedingly slippery. It is to be noted that all these cars, which besides the truck, included broughams, roadsters and victorias, carried from two to three passengers, and were stock models not driven by experts but by the owners themselves.

12,000 Miles from One Set of Batteries

The Electric Vehicle Association is in receipt of a letter from a physician in Kansas City—one of the hilliest cities in the country—extolling the virtues of the electric vehicle as used in his practice in the place of five horses for the past six years. He further states that he obtained 12,000 miles from his first set of batteries and the same mileage from his first set of tires. He also advises that the average cost of charging, which he does at home, is $7.50 a month, and that the repairs and upkeep averaged less than $5.00 a month for the six years he has had the vehicle, which is still running with entire satisfaction.

This doctor's experience is that of a large number of physicians all over the country, for the electric appeals especially to them for its low operating cost, its dependability and noiselessness, and particularly for its complete cleanliness, which is a most important factor to men of this profession.

Good Statement, As Usual

The statement presented at the annual meeting of the Ottawa Traction Company on February 1st showed gross earnings for the year ending 31st December, 1914, $1,096,-225.81; operating expenses and maintenance, $665,226.81; net earnings, $431,232.41. Out of the net earnings there were paid four quarterly dividends of 3 per cent. and a bonus of 3 per cent., 15 per cent. for the year, being a total of $281,535. Passengers carried, 25,321,547, an increase over the previous year of 1,333,664. Balance at credit of profit and loss account is now $190,273.38, and at credit of rest account $200,000. The board of directors were re-elected, viz.—T. Ahearn, president; Warren Y. Soper, vice-president; James D. Fraser, secretary-treasurer; T. F. Ahearn, Redmond Quain, Elbert N. Soper, J. F. Smellie, Thomas Workman, Travers Lewis, K.C.

The Woodstock Electric Railway, Light & Power Company have made application to the Board of Commissioners of Public Utilities for an order authorizing the company to fix a minimum net rate charge of 75 cents for all electric light accounts, exclusive of meter charges.

Automatic Electric Lighting Plants

Must Maintain a Constant Voltage and at the Same Time Ensure Proper Care of the Storage Battery—Description of a Control That is Giving Entire Satisfaction

By Leonard Andrews, M. Inst. C.E., M.I.E.E.

The use of electricity for light, heat and power has become so general in large cities, that those who have resided for a time within the range of a public power service are considerably inconvenienced when they find themselves unable to get such service. This has created a demand for small isolated plants for lighting country houses, provincial banks, stores, hotels, farm houses, etc.

The great draw-back to such plants has been that they have hitherto required a considerable amount of attention and supervision, and are often a source of trouble owing to their receiving improper treatment. The usual practice is to install a small generator driven by a gas engine or some other prime mover, and a secondary battery. The plant is generally run for a few hours every day to charge the battery which is discharged at night on the load. Where such plants are placed under the control of a skilled attendant, they give very little trouble, but where, as frequently happens, they have been left to the tender mercies of the gardener or handy man, the service is very often far from satisfactory. This difficulty has led designers to turn their attention to devising plants that shall be more or less automatic, a properly designed automatic appliance being frequently more infallible than unskilled human attendance.

Messrs. Walker Horrocks of Birmingham, England, have put on the market an automatic lighting system which maintains a practically constant pressure across the lighting circuit independently of the state of charge or discharge of the battery and at the same time ensures the battery receiving the attention which experience has proved to be necessary with hand controlled installations. Before describing this system it will be useful to briefly consider what are the conditions governing the installation of a hand controlled battery and generator installation.

Capacity of the Battery to be Installed

To determine this let us consider what are the functions of a battery. These have been defined by different writers to be as follows:

(a) To Start the Prime Mover.

For this purpose only quite a small battery is required. It has been questioned, however, whether, taking into consideration the ease with which a small gasoline engine can be started by hand, the considerable expense of installing even a small battery for this purpose is justifiable.

(b) To Prevent Fluctuations in Pressure due to Variations in the Cyclic Regularity of a Four Cycle Internal Combustion, or due to such Imperfect Governing as occurs with a Hit and Miss Type Engine.

As however, internal combustion engines can now be obtained which govern perfectly from no load to full load, and the cyclic irregularity of which is imperceptible, there is no longer any justification for installing a battery for this purpose.

(c) To Carry the Load for Reasonably Long Periods Without Running the Engine.

This is perhaps the chief reason for which a battery is usually installed as it is generally more convenient to run the plant in the day-time only. The general practice is to install a battery for this purpose of sufficient capacity to carry all the night load. In the winter months it may be estimated that lights will be required for about ten hours out of the twenty-four, the average load during this period being about 50 per cent. of the maximum load. The capacity of the battery should therefore be sufficient to carry the full load for at least five hours without recharging. Thus, for an installation of seventy 20 watt, 50 volt lights the battery should have a capacity of about 140 ampere hours with a maximum discharge rate of 28 amperes.

(d) To Enable the Gasoline Plant or Other Prime Mover to be run at its most Efficient Load.

This consideration has an important bearing on the cost of fuel, so much so that notwithstanding the losses in the battery, the fuel consumption will usually be much less for an installation in which the engine is run for a few hours each day for charging the battery and then shut down, than for an installation where the load is carried by the running plant alone. To achieve the best results in this direction, the relation of the running plant output and battery output should be so proportioned as to permit of the battery being charged at the correct charging rate when the engine is developing its maximum output. The best charging rate of a 140 ampere hour battery would probably be about 20 amperes, and a generator of this capacity should therefore be installed for this purpose.

(e) To Meet Occasional Demands for Power in Excess of the Normal Capacity of the Battery alone or of the Generator alone by Running the Generator and Discharging the Battery Simultaneously.

Allow For Power and Heating

A mistake is often made in installing isolated plants in considering the lighting requirements only, and consequently in installing a plant capable of only dealing with this portion of the load. When, however, electric power is available, the user frequently finds he requires it for other purposes, either for heating, driving electric motors for pumping work, a saw mill, or other purposes. This demand for power or heating may often be considerably in excess of the lighting load. Given a battery of ample capacity the combined installation will give an output two or three times as great as that of the generator alone.

Having settled the sizes of the plant and battery to be installed, it will be necessary to consider what is the best switching arrangement to provide for proper treatment of the battery and to insure constant pressure of supply. The usual arrangement is to provide end, or regulating, cells which on discharge will be gradually cut into circuit as the battery becomes discharged.

To provide for the entire battery being charged whilst some of its cells are discharging into the circuit, it is usual to provide a double end switch fitted with two separate bus bars, one of which is connected to the generator and the other to the lighting circuit. This arrangement for a 100 volt installation is shown in Figure 1.

The charge bar is shown in the diagram connected across 54 cells and the discharge bar across 46 cells. Assuming the average potential across each cell to be 2.2 volts, the potential across the lights would be 46 multiplied by 2.2 or 101 volts and across the generator would be 54 multiplied by 2.2 or 118 volts. When the cells are discharged to 1.8 per cell it will be necessary to connect the entire 54 cells across the lighting circuit to get the required pressure. Thus, 54 multiplied by 1.8 equals 97 volts.

Having installed the hand controlled plant, instructions must be given to the attendant as to its proper treatment. If these instructions are religiously followed the life of the

battery should be many years, but if they are neglected, the battery will be put out of business in a few months. The instructions will be somewhat as follows:

The battery must never be discharged below 1.8 volts per cell.

It must never be allowed to remain in a discharged condition.

It must not be overcharged for an appreciable time.

As the end cells will be only discharged for a fraction of the time the main battery is discharged, and each cell for a different period of time, these cells will require charging for a different period, the charge to each cell must be discontinued immediately that particular cell is fully charged without considering the state of the other cells.

Whilst it is not difficult to train a man of average intelligence to closely follow the above instructions, so long as he is able to give his undivided attention to the electric plant, it usually happens that the attendant is frequently required to devote part of his time to certain other duties during the charging period with the result that the battery suffers and some of the cells soon become sick.

In the plant under discussion the aim has been to devise an automatic controller that shall at all times follow out the battery makers' requirements. There have already been installed some hundreds of installations equipped with this extremely ingenious controller and so far as I have been able to learn, the devices, though at first sight somewhat complicated, have given entire satisfaction in every instance.

Experience has proved that where these controllers are used it is not only unnecessary to employ an attendant to supervise the charging operations, but that the battery gets better treatment than it usually receives at the hands of an average attendant.

Figure 2 is a reproduction of a photograph of Messrs. Walker Horrocks' standard battery automatic controller. Two bus-bars, connected respectively to the generator and

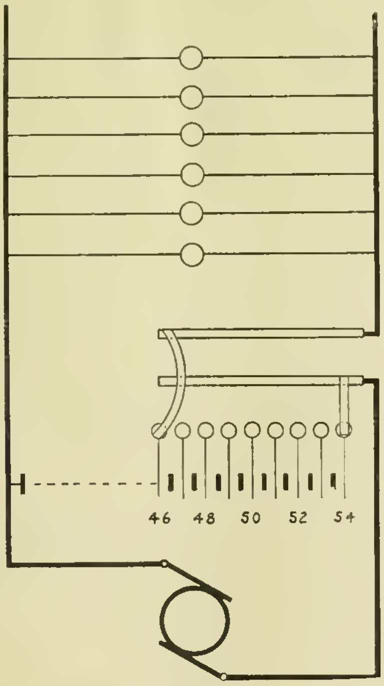


Fig. 1.

lighting circuit, are used as shown diagrammatically in Fig. 1, the bus-bars being, in actual practice, one above the other. The contactors connecting the regulating cells to the respective bus-bars are carried on a screw threaded spindle. This spindle is rotated by a small electric motor at the back of the board, the motor being constructed to run in either direction. This automatically shifts the contactor from right to left or vice versa as may be required, thus giving, continuously, steady pressure on the lighting circuit. The motor is controlled by the various relays shown on the face of the board, the respective operations of which I will endeavor to explain with the help of diagrams.

The makers have sent me a number of diagrams showing the connections at the back of the controller, but I have found it somewhat difficult to follow these diagrams, with their numerous cross connections, and I have thought it better therefore to pick out a few of the essential features and

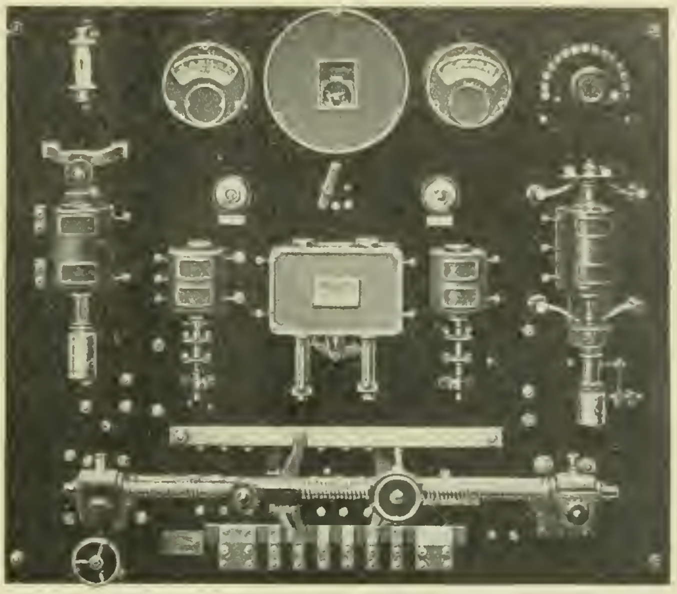


Fig. 2.

embody these in a diagram illustrating the principles upon which the operations of the device are based. This diagram is reproduced in Fig. 3. It bears little resemblance to the actual construction employed, but it will, I trust, enable you to understand what the makers have aimed at, and achieved, in practice.

It must be clearly understood that the diagram shown in Fig. 3 is not even diagrammatically correct. I have merely used this diagram to endeavor to explain the basic principles upon which the device is based. I have embodied in it such fragments of information as I have been able to obtain respecting the actual designs and have filled up the gaps by entirely empirical designs of my own to make a diagram of a more or less complete working system.

In place of the parallel bus-bar shown in Figs. 2 and 3 semicircular bars are shown, the upper one being the charge bar C and the lower one being the discharge bar D.

The positive end of the battery is connected through the main fuse F and ammeter A to the lighting load and back through the discharge bus-bar D, and its contactor I to one of the end or regulating cell contacts. When the starting switch SS is closed, there is an alternative path from the ammeter through the reverse current breaker RC, the generator G, starting switch SS and charging bus-bar C, and contactor H to another end cell contact.

The contactors H and I are carried respectively on radial arms H_1 and I_1. These tend to close together under the action of the spring, shown dotted around the fulcrum, but are prevented from doing so by a train of wheels on the right and left respectively. The left side train of wheels is driven in either direction by a worm wheel mounted on the shaft of a small pilot motor, P. This motor is provided with two fields, F_1 and F_2, a current in either one of these fields causing the motor to rotate clockwise or contra-clockwise, depending

on which field is energised. This pilot motor is controlled by a master relay MR.

Let us suppose that the diagram represents the positions of the respective switches shortly after the battery has been discharged and charging operations have just commenced. We will suppose that the pressure required across the lights is 50 volts and that the average potential across the battery is 2.2 volts per cell. Under these conditions 23 cells across the discharge circuit will give 50.6 volts. As, however, 28 cells in all are being charged, the voltage across the generator will be 62 volts. As the charge continues, the voltage across each cell will gradually rise. The master relay MR is adjusted to operate with a voltage variation of 3 volts. If, therefore, the pressure rises to say 51.5 volts, the relay will close the circuit through the field F_1 and the pilot motor will immediately rotate in a direction to cut out one cell.

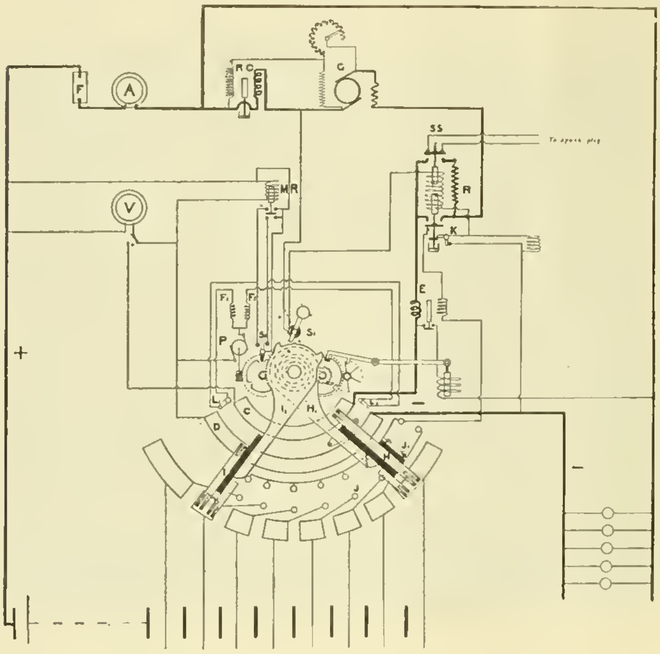


Fig. 3.

The contactors I and H are of course each divided into two brushes insulated from each other and interconnected through resistances to prevent the cells being short circuited in moving from one contact to another. It is of course essential to insure that the contactor will not be left half-way between the contacts of two cells, as, should this occur, the intermediate cell would be very soon completely discharged through the resistance between the contact brushes. To insure the motor stopping when the contactors are fully on a contact, the switch S_2 is used.

The master relay merely starts the pilot motor. As soon as this has happened the switch S_2 is thrown over to the left hand contact thereby short circuiting the master relay contacts and keeping the circuit through F_1 closed until the tail piece of switch S_2 drops into its next gap and breaks the circuit at this point, thereby stopping the motor. These gaps are so placed as to open the switch S_2 when the contactor I is centrally on each contact.

Should the voltage across the system fall to 48.5 volts, the master relay would close the circuit through F_2, causing the pilot motor to run in the opposite direction thus cutting another cell into circuit and again bringing the pressure across the supply to over 50 volts.

It will be noted that the range of variation under which the relay operates is slightly greater than the maximum voltage of any one cell. This is necessary to prevent hunting.

When all the regulating cells have been cut out of circuit the radial arm I_1 comes into contact with the limit switch L_1, thus opening the field circuit F_1 and preventing the motor from moving the arm further in a clockwise direction. When the voltage across the final cell rises to a point indicating that this cell is properly charged, the end cell relay E closes the circuit through the solenoid controlling the clockwise train on the right and allows the radial arm H_1 to move on to the next contact, when the catch drops into the next notch on the disk and thus prevents further movement.

The shunt winding of the end cell relay E is connected between the final cell that is being charged and the next cell through the contactor J_1 and the contact studs J. This contactor J_1 is carried forward by each movement of the radial arm and consequently always connects the shunt winding of this relay across the end cell that is being charged.

It will be obvious that the measurement of the voltage of the end cell is not in itself sufficient indication of the state of charge of this cell, as the total potential will be the combined result of the counter e.m.f. of the cell plus the product of the current and the resistance of the cell, and the latter will depend upon the rate at which the battery is being charged. Thus the voltage of a fully charged cell may be 2.3 volts per cell when charged at a low rate or as high as 2.5 volts per cell when charged at a high rate.

To provide for this variation the end cell relay E is wound with a series and shunt winding, the former being connected up to oppose the latter. The relay will thus take an increased voltage to operate it when the cell is being charged at a high rate.

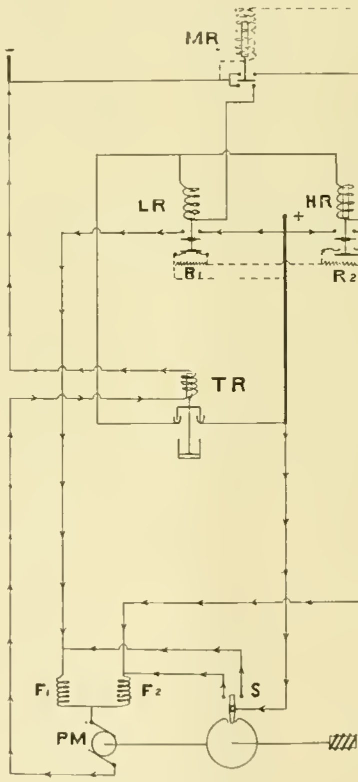


Fig. 4.

When all the end regulating cells have been cut out of circuit, which only occurs when the entire battery is fully charged, a projection or horn on the end of the radial arm, I_1 throws the switch S_1 over to the position where the brushes connected to the starting coil no longer make contact with the commutator segment shown in the diagram. This opens the starting switch SS and at the same time short circuits the spark plug and cuts off the gasoline to the engine, thereby shutting down the generating plant.

The load is now carried by the battery alone and as this gradually becomes discharged, cell after cell is inserted until

all the end cells are in use. The radial arm H_1 will be pushed back in a contra-clockwise direction by the two arms I_1 and H_1 coming in contact with each other. When both arms have been driven over to the extreme right, the limit switch L_2 will be opened which prevents the pilot motor from driving the arm further in that direction. At the same time, the other projection on the radial arm I_1 will again throw the switch S_1 over to the position shown on the diagram completing the circuit through the starting coil solenoid. This solenoid is fitted with two cores, the lower one having a dash pot attached to it to introduce a time limit. Immediately circuit is completed, the upper core is pulled down, thus closing the circuit through starting resistance R and starting the generator as a motor. The lower solenoid rises slowly, gradually cutting out the resistance and finally short circuiting it. At the same time it opens the small switch K and thus inserts in circuit the solenoid controlling the fuel supply.

A reverse current circuit breaker is inserted in the generator circuit to prevent the battery feeding back on to the generator as in ordinary battery systems. As it is required that the generator should be motored for a short time, this circuit breaker only operates after the generator continues to take current from the battery for more than a pre-determined time. This may occur through the gasoline tank being allowed to become empty under which conditions it would of course be a useless waste of energy to continue to drive the plant from the battery. Should the reverse current breaker operate, attention is drawn to the matter by ringing a bell, or some other convenient indication is given.

Those who have experimented with relays for controlling electrical circuits will appreciate that the simple relays shown in the diagram would not work satisfactorily in practice. In the first place there would be serious arcing at the contacts which would cause these to burn and weld together through making improper contact. In actual practice this difficulty is overcome by the ingenious arrangement shown in Fig. 4. The solenoid of the master relay, MR is connected across the lighting leads. This relay closes the circuit either through the high reading relay HR, or low reading relay LR. These secondary relays in turn connect the alternative fields of the pilot motor to drive this motor in one direction or the other as may be required. So long as the potential is more than 49 or less than 51 volts, the solenoid of the master relay will float between the upper and lower contacts. Should the potential rise to 51.5 volts, the circuit will be completed through the upper contacts and high reading relays.

This immediately lifts the core of this relay and short circuits the resistance R_2 in series with the master relay solenoid, thereby insuring the master relay making definite contact. The high reading relay then closes the circuit through the field winding F_2 of the pilot motor and causes this to commence to rotate, thereby closing the switch S and short circuiting the relay. The current through the pilot circuit passes round the solenoid of the time element relay cut-out T but this cut-out is prevented from responding instantaneously by a dash pot attachment. The time is however adjusted to break the relay circuit before it is broken at the switch S, thereby allowing the core of HR to descend and again insert resistance R_2 in the winding of the master relay.

Should the voltage fall to 49.5 the circuit will be completed through the low reading relay, closing the circuit through the pilot motor field F_1. In the case of the low reading relay, the lifting of its core inserts additional resistance R_1 in the master relay circuit, thereby more definitely closing the lower contact.

It is a debatable point as to what is the best voltage to use for these isolated plants. The cost of the battery will obviously be very much less for a 50 volt plant than for a 100 volt plant. On the other hand, there is some advantage in keeping to the standard voltage of 100 or say 110 volts, thereby permitting standard heating appliances, motors, etc., to be used on these isolated installations. It appears to be doubtful however, whether this advantage is sufficient to justify the greatly increased outlay on the battery as heating appliances, etc., can of course be obtained for 50 volt circuits.

The necessity of using absolutely reliable engines for automatic lighting plants referred to earlier in the paper has been observed in the Walker Horrocks' plant, the engines being all made by the Austin Motor Car Company who have the reputation of turning out one of the most reliable motor cars on the market. This same system of automatic control has also been successfully applied to water power installations for village lighting. Fig. 5 is an interior view of the Kintbury, Berkshire, England, power house and shows the method adopted of driving the generator from the pulley on the turbine shaft through a laminated endless belt. The small ½ h.p. motor shown in the corner is employed to operate the sluice gates.

Fig. 5.

The operations of this plant are as follows:—When the battery falls to a predetermined voltage a relay actuates the sluice motor, gradually opening the sluice, allowing water to get to the turbine, which begins to drive the dynamo, and when the dynamo excites and builds up, the Neville cut-out operates, and the charge commences. The discharge switch cuts out cell after cell as the voltage of the battery rises, keeping the line voltage practically constant. The charge switch is also operated automatically by means of two relays so that when the end cell in the charge has received its full charge it is cut out of circuit. When the battery is fully charged the sluice operating motor is actuated in the reverse direction, shutting off the water in the turbine. The Neville switch operates, disconnecting the battery from the dynamo, and the plant comes to rest.

According to a statement issued recently by the Winnipeg Electric Railway Company, approximately six hundred civic employees and officials are carried free at all times on their cars. Five hundred and thirty-five of this number are accounted for by the police and fire departments, and the remainder are mostly inspectors employed by the health, building and license departments. By this means alone, the city effects a saving of approximately $100 each day. In addition to this it is pointed out that the pay roll of the company for 1914 amounted to $1,574,976.35, and that the amount expended for material and supplies during 1914 was $1,206,379.73.

Electric Railways

Eighteen Passenger Omnibus for Congested City, Suburban or Interurban Service

The omnibus is making decided progress at various points on this continent as a satisfactory solution of the transportation problems in city congested, suburban or interurban service.

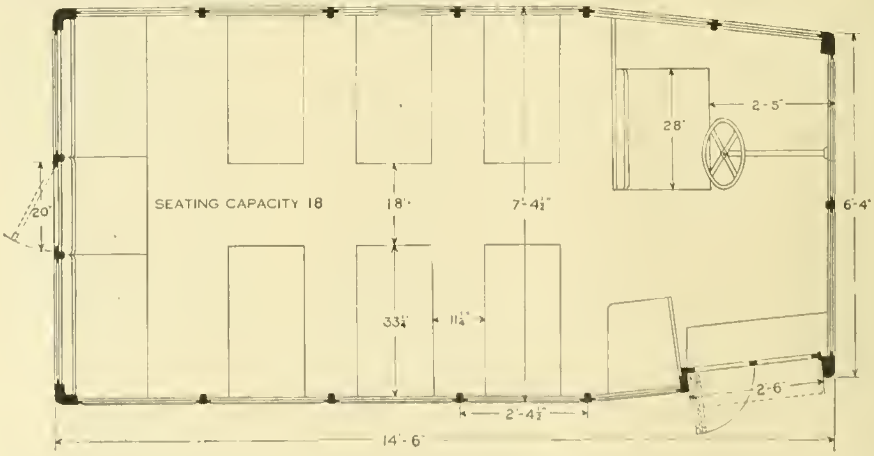
The bus illustrated was delivered a few weeks ago to the Hornell-Allegheny Transportation Company by The J. G. Brill Company, and is now in operation on a regular schedule between Alfred Village and Hornell, in southwest New York, running through the intermediate towns of Alfred Station and Almond, a distance of 11½ miles. For nine miles of this distance, between Alfred Station and Hornell, which is a growing city with a population of some 15,000 the route is parallel to the tracks of the Erie Railroad, and since its inauguration has become so popular that the passenger traffic between these two points, formerly controlled almost exclusively by the railroad, has been considerably diverted. Three round trips are made by the bus each day, travelling in all about 70 miles.

The body was designed, like all Brill-built busses, to meet the conditions under which it is operated. A three-ton Chase chassis, having a wheel-base of 165 inches, supports an underframe constructed chiefly of ash, with three 3-in. channel crossings, webs vertically placed. In addition there are four 1⅜ by 3-in. crossings, side sills of 2¼ by 4 in., front end sill 1¾ by 4 in., and rear end sill 1¾ by 5½ in., all of ash. The posts in the body framing are also of ash and include corner posts, 3½ in. thick, side posts 1½ in. thick, and rear door post 1¾ in. thick. A poplar sheathing, ⅜ in. thick, covers the body framing below the window rails.

The entrance-exit folding doors on the forward right-

OMNIBUS FOR SOUTH-WESTERN NEW YORK.

Driver operates two-leaf door in conjunction with bottom step, which folds, the second step being stationary. Mounted on three-ton Chase chassis, with 165-in. wheel base.



OMNIBUS FOR SOUTH-WESTERN NEW YORK.

Height from underside of side sill over roof, 6 ft. 11-13/16 in.; floor to centre of headlining, 6 ft. 9⅛ in.; road to first step, 14 in.; riser 11 in. Weight of body, 2,400 lbs.; weight of chassis, 4,800 lbs.; total weight, 7,200 lbs.

hand side of the body are operated by the driver in conjunction with the lower part of the step, and their position enables the driver to collect the fares in addition to his usual duties of running the bus. The upper half of the step is stationary and is set into the body beyond the side sill, which terminates at the body door post on this side of the body. Next to this door only a single seat is permitted, as shown in the diagram of the seating arrangement. Opposite the door opening on the left side is the driver's seat, upholstered in leather, the chassis being designed for left-hand drive. Under this seat is the gasoline tank, affording a convenient and suitable compartment. The transverse stationary-back seats, the single seat next to the door opening and the cross-the-body seat against the rear end are upholstered in twill-woven rattan, all being of Brill manufacture. A central section of the rear seat is removable, being directly in front of the emergency door, which is controlled by the driver with the lever at the front end. All sashes are double, the upper part being stationary and the lower arranged to raise. A stationary hood directly in front of the driver's position prevents stormy weather obscuring the glass in front of his vision. The interior is finished in ash, and the roof boards and carlines of the ceiling show. In cold weather the bus is heated with heaters connected to the exhaust of the engine, with suitable valves so that the heat may be transferred to the muffler when desired.

The "Code of Principles" in Practice

By Col. T. S. Williams*

The subject upon which I have been asked to address you is not so dull as its title, without explanatory preface, might imply. It embodies, in fact, an attitude and a determination full of business significance and human interest. The workers in an industry employing 282,461 persons and representing $4,596,563,292 of invested capital have not merely formulated a declaration of the principles which shall animate their purposes and guide the conduct of their business—they have asserted and propose to defend a sound and honest basis of business opportunity. More than any other public utility, the street railways of the country stand in close relationship with both people and government. The opportunity of their development is, unfortunately, public privilege The continuous performance of their functions is a public necessity, and the manner of that performance is, of all public services, the most intimately associated with the time, the comfort and the welfare of the people. Wide-reaching then, and of universal interest, is the standard of obligation assumed by such an industry and the conception of fair play which it contends for.

I regard as perhaps the most important and timely work ever undertaken by the American Electric Railway Association the effort which has culminated, during the past year, in committing the association to earnest and intelligent propaganda for encouraging among its member companies the recognition of a high standard of business obligation, and for disseminating among the people clear and sound ideas of that mutual relationship which must prevail if street railways, under private ownership and operation, are properly to perform their functions. Necessarily preliminary to such propaganda was the attempt to formulate certain underlying principles of belief and action—called, perhaps too comprehensively, our Code of Principles. From these were to radiate illustrative studies based upon all the information which is furnished by our industry. The association was to be not merely a storehouse of facts, figures and experiences but a ready disseminator of these, both among our members and throughout that great collateral constituency with which our activities are so intimately related. We became by this undertaking an alert and aggressive force, combining varied and expansive experiences under concentrated leadership, for efficient methods and broad ideas. I am sure I voice the unanimous feeling of the committee which, at the direction of the association, outlined the scope of this large educational program, when I pay tribute to the sincere co-operation which the committee received in its work from the members of the association, and if the earnestness of spirit which characterized the strong men in the organization toward our undertaking be typical, as I believe it is, of the general attitude, a new and useful era is before us.

In Spirit of Honesty and Militancy

What we have done is merely to nail our flag high and indicate that we intend to defend it. We do not ask you to indorse the precise language in which our principles have been phrased. You may like all of them or you may question some of them. You might phrase them differently. We believe them to be generally sound, and the association has approved them. But the important thing is the spirit behind them. And you will all agree that this spirit is an honest one and a militant one. This is their note of triumph and courage. This is their significance in these days of mollycoddling in business, politics and economics.

Because public privilege in the shape of franchises has usually been incident to the existence and growth of street railways, evils have arisen for which we perhaps, equally with official representatives of the public, are responsible. History will determine the relative measure of that responsibility. Whether blackmail or theft, involves merely the definition of the crime. I have no apologies to present for those instances of corrupt alliance between franchise-giver and franchise-taker, which have brought discredit both upon business and upon politics, nor for those dishonest and reckless financial manipulations which have beclouded some railroad operations and covered some reputations with scandal.

Nor would I urge that we should forget and forgive these deplorable incidents as the products of a lower moral standard and not likely to recur. The remembrance of them is a wholesome deterrent. But it must be borne in mind that no business, large or small, has been free from similar evils, and we have a right to insist that public service corporations should not be the special victims of public prejudice excited by such misdoings.

The street railway corporation is under specially severe restrictions in the department of its business. Its obligation is to serve the public with transportation, but it cannot occupy a foot of public street without express official consent. The difficulties of procuring such consents have, in many of our cities, become almost insuperable—and they exist largely because of prejudice and suspicion generated easily by demagogues who still thrive on some possible wrongs of the past. This same antagonistic spirit, too prevalent against all manifestations of enterprise, seeks to impose all kinds of exacting burdens as well as to prevent expansion, with the result of withholding from the people those facilities which ought to be theirs even without the asking.

It is this fact of dependence upon privilege, with the concurrent atmosphere of suspicion and envy of possible rewards, which makes all public service activities a doubtful

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business—doubtful in permanency of private control, doubtful in opportunity of profit, doubtful in assurance of fair play —and we may well feel at times that the inexorable logic of conditions (not of results) points inevitably to government control and government operation.

The public service most difficult of all to render in our large cities is transportation, and because the railroads are brought into such constant association with the people and are expected to furnish facilities which they are not always allowed to furnish, they are likely to be among the first victims of public prejudice or political demagogy.

No Security for Utilities

The situation which confronts the street railway business is thus a peculiar one. There is in the first place no free field of effort. There is no assurance against competition. There is little security in rates. There are incessant and increasing demands for improvement in the character and frequency of service. There is the frequent deadlock which springs from the irreconcilable conflict of demand and inability to comply. There is the daily prejudice of ignorance and of unreasonable dissatisfaction. And there is, from the viewpoint of public concern, the constantly menacing evil of government railroading, with its certain train of extravagance and inefficiency. The situation is further complicated by the existence of some perpetual franchises which have proved profitable, and in eagerness to attack these is forgotten the almost invariable sequence that, for every dollar of profit to street railway owners, the people of a community, its business and its real estate, its growth and its social environment, have received many fold in diverse dividends.

Confronted by these conditions, the American Electric Railway Association has taken the manly and intelligent course. It seeks first to remove prejudice and then to deserve support. Frankly avowing the sense of public obligation inherent in the transportation business, it makes the recognition of that obligation the fundamental precept of its platform The keynote of its code is responsibility, frankness and fair play. Mark the courageous tone of its fine paragraph:

"The first obligation of the public utilities engaged in transportation is service to the public. The first essential of service is safety. Quality of service must primarily depend upon the money received in fares. For this reason it is necessary that the rate of fare should be sufficient to permit the companies to meet the reasonable demands of patrons and to yield a fair return on a fair capitalization."

The Platform Epitomized

Here is the whole platform in one paragraph. But the association has properly realized that in its own councils and in the contact of its members with the public an expression of opinion and attitude is called for upon many questions which involve the life of street railway corporations and the correct settlement of which determines the scope of their usefulness The association's code meets these with equal straightforwardness. It holds that regulated private ownership and operation of electric railways are more conducive to good service and the public welfare than government ownership and operation, because the latter are incompatible with administrative initiative, economy and efficiency and with the proper development of cities through the extension of transportation lines; that in the interest of the public and good local service transportation should be a monopoly and should be subject to regulation and protection by state, rather than by local authorities; that short-term franchises are detrimental to civic welfare and growth because they ultimately check the extension of facilities and discourage good service; that in order to render good service, fair return must be allowed on a fair capitalization, and the issuance and sale of securities representing such capitalization should be legally authorized on such terms as will produce the requisite funds; that securities lawfully issued should be regarded as valid obligations; that the relation of adequate wages to efficient operation should always be recognized, but electric railways, being public servants regulated by public authorities, should be protected against excessive demands of labor and strikes; that the principle of holding companies is economically sound for the reason that the securities of local companies have protection against the varying business conditions of a single locality or company, and because money for construction and improvements can thus be more readily obtained; that in the appraisal of an electric railway for the purpose of determining reasonable rates all methods of valuation should have due consideration; and, finally, that full and frank publicity should be the policy of all transportation companies, to the end that proper information may be available to the investor and the public.

Mutual Responsibility

There is thus presented in this code of principles a two-sided obligation—the obligation of the carrier to the public, and the obligation of the public towards the carrier. The mutual responsibility is so self-evident that argument would seem to be unnecessary, but the real evils from which our corporations in common with others are suffering to-day arise from the failure to appreciate this mutual responsibility. The obligation of the railways to the public is forced home upon them in many ways, but the obligation of the public towards the railways is not only not recognized but is often contemptously repudiated. I speak now out of obligation in the sense of debt, for I appreciate that people dislike to be regarded as debtors and particularly to corporations of their own creation, and I make no mention of those great participations in town and country upbuilding which have followed the courageous lead of transportation—achievements often due exclusively to the nerve and determination of railroad pioneers who are, in this sense, indeed public benefactors. But I speak of obligation which involves only justice and fair play. I call attention, particularly in municipal transportation, to that close relationship to which I have before referred, as being so essential between city and corporation— first, that the city may get the transportation which it wants, and, second, that the corporation may give it. People forget or overlook the interdependence of this relationship. So long as our municipal policy is to employ private agencies to furnish and conduct its transportation, so long must there be two parties to the contract, so long two contributors to the results. If you expect your street railways to furnish facilities of transportation, you must give them the power; if you give them the power, you must see that they properly exercise it, and if they do properly exercise it and succeed by their effort, do not penalize them or attempt to strip them of their reward.

Our association aims, as I understand it, to impress upon its own members a full sense of our own obligation towards those whom we serve, and also to drive home to the people a few plain economic truths which must be self-evident to sensible men but which unfortunately are not always the basis of popular action, although they involve merely a recognition of reciprocal honesty. Transportation is a commodity. It resembles other commodities in that it is bought and sold. The city is the buyer, bartering its privileges for the benefit of its people The railroad company is the seller, furnishing the facilities of transportation in such streets and places as the buyer determines and under such restrictions and conditions as the buyer dictates. Self-interest on each side, to the extent reconcilable, inspires and formulates the bargain. Once made, it is supposed to be carried out. The results may be disappointing to one side or to the other or to both, but there must be absolutely good faith between buyer and seller. Long is the list of enterprises in street railways

where investors have lost, but the railroads have continued their operations; they have kept the faith, while the city, the other party to the contract, and its people, have received all the benefits. The experience of the comparatively few successful enterprises has not always shown that they have been allowed their full reward, however. Their success, even when accompanied by vastly greater compensations to city and people, has too often meant the exaction of new concessions, the imposition of new burdens or the creation of competing lines.

Contracts Should be Sacred

We stand on unassailable ground when we insist upon the sacredness of contract and upon honest and fair dealing. In order to demand it of others, we require that we should respect it ourselves. We therefore favor "full and frank publicity." We propose to take the people into our confidence and give them the facts and figures of our business, not alone the official periodic reports which they have generally had under the direction of law, but the live information which helps the public promptly to form accurate judgments. We admit the desirability of regulation, but we believe that regulation, too, should have a moral code—that it should be honest, fair and intelligent, not an official instrumentality for oppression, punishment, unreasonable exaction or political baiting. We insist upon the square deal, whether it relate to capitalization, to rate making, to franchise burdens or to taxation. We recognize the increasing demands for both the quality and quantity of electric transportation, but we urge with insistence that should not be necessary the dual interest of expending facilities, and that no extensions and improvements can be permanently forthcoming without a sound basis of credit.

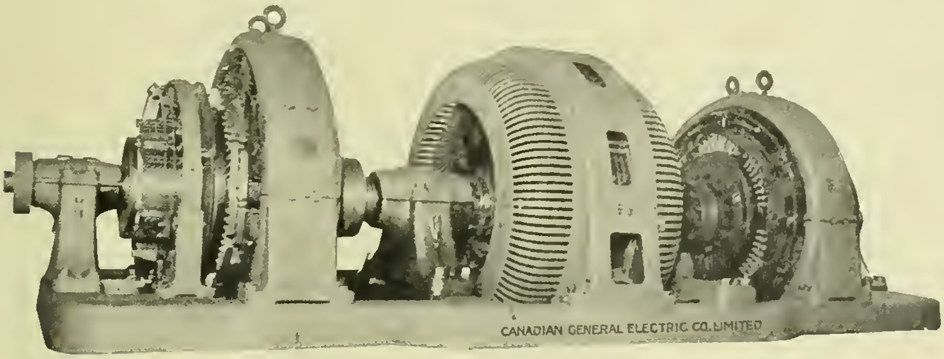
Such a basis for expansion implies an equitable margin of profit—compensatory returns for both labor and capital. I am often impressed with the fact that we have become the victims of our own liberality and optimism. Electric power has so improved and cheapened transportation that we have deceived both ourselves and the public as to its possibilities Too careless accounting and too many official impositions have been extravagant accompaniments of lower fares, longer hauls and generous free transfers. The nickel is called upon to do too much. Having learned by the difficulty of enlisting new capital in traction ventures of the narrowing margin of profit and of the lessening ability for expansion and even for the maintenance of high physical standards, we owe it to the public, as well as to ourselves, that the truth should be emphasized. Our patrons are equally interested with us that fares should be adequate and that operating and fixed charge costs should be proportionate. This is not an academic proposition. It affects vital interests. Our invested hopes and dollars are only a small factor. Our past optimism and prodigality may now seem to have been ill-advised, but they have built up great communities, scattered urban homes over long distances, choked the only avenues of distribution permitted to us, and in our large cities have brought about a situation which cries aloud for relief, in the interest of humanity, of business and of future civic progress. To the real and important sufferers from this situation every fact bearing upon the explanation and the remedy should be pressed home, if we are to be the instrumentalities of their relief.

Equipment for Montreal Tunnel

"The cut below shows one of the Motor Generator Sets which the Canadian General Electric Company is supplying in connection with the equipment for the electrification of the Montreal Tunnel of the Canadian Northern Railway.

Two 750 kw. 1,200 v. generators are driven by a 2,100 h.p., .8 p.f. synchronous motor operating on 11,000 v., 60 cycle energy. The generators are connected in series to give 2,400 v. direct current for the operation of the locomotives and motor cars in the electrified zone. The generators are compound wound and have commutating poles and pole face windings, and the set has a normal full load rating of 1,500 kw. and the exceptionally high overload rating of 300 per cent. load, or 4,500 kw., for five minutes.

The pole pieces, both main and commutating, are of laminated steel bolted to a cast steel magnet frame. All the field windings are wound on insulated spools, copper strip being used in the series and commutating field construction. The pole face winding, series and commutating field windings are all connected on the ground side of these machines, so that the armatures are the only portion of the direct current generators subjected to the full line potential of 2,400 v.



Motor-Generator Set for Montreal Tunnel Two 750 kw., 1200 volt generators driven by a 2100 h.p., 11,000 volt, 60 cycle synchronous motor.

The shunt fields of the direct current generators and the synchronous motor field are arranged for 125 volts excitation. These sets are equipped with a voltage limit device to de-energize the separately excited generator fields when the circuit breaker is opened.

The heavy overload capacity of these machines is assured by the pole face winding. This winding of tubes and rods through holes near the pole faces is so connected as to directly oppose the armature reaction, this insuring satisfactory operation under any of the specified loads or overloads without necessitating a machine that is normally underrated.

The generator armature cores are built up of thin steel laminations assembled in groups with large radial air ducts for ventilation, and are mounted on a cast iron spider. Cast iron flanges are used to hold the core together and support the end windings. The armature windings are made up of strip copper, varnished, and insulated with mica and asbestos. This gives an insulation that is unaffected by heat at any of the specified loads or overloads.

The commutators are built up of hard drawn copper segments insulated throughout with mica, and held by iron clamping rings mounted on a cast-iron shell. The armature spider and commutator shell are keyed to the shaft so that no movement between the two can take place

The Dealer and Contractor

Letters to the Editor—Further Discussion of the Electrical Contracting Field and its Needs

Editor Electrical News,
Toronto, Ont.

Judging from the articles and letters in recent issues of the Electrical News, and current talk in some quarters re electrical contractors, it would seem that the business is at present in a pretty bad way.

It would seem that incompetent, quack, etc., are intended to refer to quite a large class but, if all that is said and hinted be true in the last analysis, should not the word "dishonest" be applied, because, at rock bottom, is it not really a form of dishonesty not to live up to the spirit of the code? Is it not a breach of faith, both to the underwriters and the public at large, considering that a fire risk is also a life hazard?

Now **has** the case been correctly diagnosed? In other words, is the business really suffering from "the **use** of a bad thing," i.e., from the operations of incompetents?

The aforesaid communications, etc., tend to give that impression, but is that on the whole correct?

Might not the business, on the other hand, be suffering from " the **abuse** of a good thing," i.e., from the operation of those who, specialists in one field, are, although well-intentioned, invading another without the necessary qualifications?

After all, is not the whole electrical industry a specialized one, perhaps more so than any other, and may not this, owing to its rapid growth, account for the dearth in it of all-round, capable men?

That being recognized, it is easy to see how a specialist in one line may be ignorant of the essentials of another line, which he gets into, and, with this in view, may not the industry be suffering on the one hand from a lack of capable, all-round men, and on the other, from a plethora of specialists going out of their sphere,—with the best of intentions, however, be it noted!

For instance:—

(1) Is a firm specializing in machine work and installation likely to be all that it should in the lighting installation field, especially if it employs the same labor for both?

(2) Is a firm specializing in fixtures likely to do the work it should, if it undertakes wiring, repairing and installation work and sends out chiefly a "fixture man" to do it—capable though he may be in "fixture hanging"?

(3) What happens to the jobbing firms when they undertake machine and lighting installations?

(4) What would the Underwriters think of "rules and regulations" for the benefit of the fire hazard field prepared by a well-trained electrical engineer,—most successful, no doubt, in power problems, and where would the fire hazard expert figure in most cases in the power plant field?

(5) Considering again the wiring installation contractors—many a "small" man handles to advantage and profit a class of business (chiefly for speculative builders and the average house owner), at prices which a "big" man could not touch. It does not **necessarily** mean, as the big fellow seems to be so apt to think, that the other is incompetent, cutting prices, killing the trade, etc., but it means that he specializes in that class of business—has the facilities for handling it, including, perhaps, specially trained labor. On the other hand, has not many a successful "small" man put himself out of business by going into contracts which a "big" man can handle with profit?

To make a long story short is the crux of the situation a case of the highly complex gears of the whole electrical machine being defective, or is it not rather a case of bad meshing of good gears? Then, a good adjusting system is the desideratum with a "master" mechanic at the head.

And is there not the nucleus of such a system right at hand, having at the head the man who unassumingly, for the underwriters, in a few short years, brought electrical conditions out of the chaos of 1914 to a place where (before the advent of hydro-electric power distribution) the central station would not connect up a load unless the installation were O.K.'d by the C. F. U. A. Electrical Department,—and that without the aid of "special legislation." The licensing proposal emanating from that source shows that the situation is understood and also how to deal with it.

Perhaps it might not be out of place for me to express the opinion that the proposal to exact a bond is a good one, and to suggest that a certain amount of red tape might help, but care should be taken re permits, filing of plans, specifications, etc.,—not to treat the all-round man as a "wrong one," in an endeavor to keep the specialist from side tracking.

Yours truly,
(Signed) Thos. Jackson.

Toronto, Ont.

Standard for Electrical Wiremen

Editor Electrical News:

The question of forming a standard for electrical wiremen has often arisen, probably because of the general public knowledge of the work being done in this line by men totally inefficient and incapable, not from any wilfulness on their part, but rather, on account of their small idea as to the significance and importance arising from electrical developments and complications, and I might make free to say that, as has already been necessitated by different governments, the proper qualifications needed in other lines of mechanics, less important than electricity, it seems to me a standard should be made, which will protect the public against any work being done in a haphazard way, which might even escape the notice of a Government Inspector and have such a standard set whereby all men in charge of electrical installations will be required to hold a certificate of qualification; the system could be worked out to mutual satisfaction. Conditions arise daily that make it seem a necessity for such a standard in order to safeguard property owners

in general and if so, it is certain that insurance risks would be more readily placed and entail less expense.

Cases are daily brought to light where inspectors have had to make several inspections, where, if men of qualified experience had installed the work and installed it conscientiously, one inspection would have been sufficient. Self-preservation is the first law of nature and in this respect, it would not be a selfish law, for the result of standard installations would be beneficial to all.

In conclusion, as a suggestion, let there be an authority on wiring and have it such that unless a man can fully master the requirements of such an authority he be withheld from a certificate of qualification, which could be given from an examination presided over by capable men. It would soon work out to be less trouble and expense to both the contractor and householder and, in any case, time is money and money is what we work for, and no one wants poor work, especially along the line of electricity.

Yours very truly,
(Signed) V. K. Stalford.
Chief Electrical Inspector.

Hamilton, Ont.

Examination and License

Editor Electrical News:

In your issue of January 15th, 1915, the article "Electrical Contractors of Quality" written by George J. Beattie, should be of the greatest interest to those who follow electrical construction.

It is a fact that the electrical contractor of to-day receives less consideration than almost any other trade, and this is due to the fact that a large percentage of electrical workers are not as competent workmen as they should be.

It would be difficult to mention a trade that uses a greater variety of materials than the electrical trade uses to-day, or a business that calls for more real brains in the erection and construction of a properly equipped system of lighting or power.

Conditions are different, and systems are different in almost every piece of work performed. Therefore, too much care cannot be taken to ensure the customer a neat, safe and efficient installation.

How to improve the standard of the electrical worker is a problem. If he had to pass an examination and secure a license before being allowed to enter the field as a contractor, it would surely be a step in the right direction, and if he proved to be incompetent, his license should be cancelled until such time as he became an expert workman.

The contractor who employs a number of men knows that the most skilled men obtainable will do his work cheaper than his understudys, and that they are the best possible advertisement for his business.

If the average bagman could get work with a reliable contracting firm his earnings would be greater, as he must spend considerable time estimating, ordering material and collecting payments, etc., but the fact is, he is usually not an expert and cannot get a permanent position, therefore he starts as a contractor, and there is where the trouble begins.

The Inspector's work and worry is increased, the reliable contractor wastes his time estimating, and the customer who pays for the work suffers in the end, as the cheap job often has to be taken out and new work installed by a reliable contractor.

The bagman's responsibility ceases when he is paid for his work.

It is time something was done to safeguard the public, to protect the legitimate contractor, and to put the electrical contracting business in that dignified position to which it rightfully belongs.

Yours truly,
(Signed) A. D. Smith.
Electrical Inspector.

Fort William, Ont.

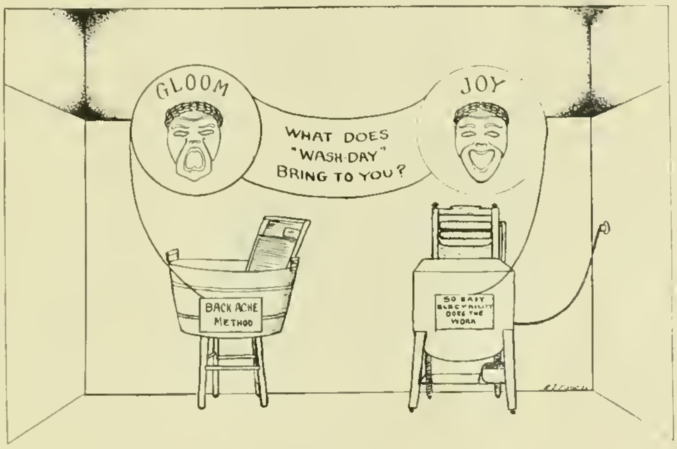
Suggestions for a Washing Machine Display

By A. J. Edgell, Display Service Bureau, Society for Electrical Development

Monday has been "wash-day" since time immemorial. Sunday's rest has been marred for the housewives by the thoughts of "Blue Monday" with its heart-straining back-breaking tasks.

The electric washing-machine is rapidly freeing many women from this type of slavery, and Monday has become "sunny."

To convey this idea to the passers-by the accompanying suggestion is intended: Two heads, one representing "Gloom," the other "Joy" can be obtained from a card-writer. These are mounted on circles and fastened to the background of the show-window. (If the background is of the open kind, the circles may be hung on wires). Between the circles is a panel inscribed "What does wash day bring to you?" A narrow tape or ribbon runs from the "Gloom"



A suggestive washing machine display.

circle to a wash-tub with rubbing board. From the "Joy" circle tape runs to an electric washing machine. The tub is marked: "Backache Method." The electrical washer is marked "So Easy. Electricity does the work." The electric washing machine might be filled with water, soap stirred in, and the machine operated. The constant motion of the white, glistening foam brings visions of snowy white clothes to the passing housekeeper. Other electric washing machines and electric flat irons might be shown in a window of this kind. On one of the machines, a mirror should be arranged at the back, in such a manner, that it will reflect the simplicity of the interior. This can be done by tipping the mirror at an angle. A view of the interior serves to eradicate from people's minds, the idea that the mechanism is complex.

Railway Franchise in Three Rivers

By a substantial majority the citizens of Three Rivers, P.Q., have agreed to grant a 20-year franchise to the Three Rivers Traction Company, which will at once commence the construction of an electric line to serve the city and the outlying districts. The company is a subsidiary of the Shawinigan Water and Power Company, Mr. Thomas McDougall, chairman of the Shawinigan board, being president of the company, Mr. Julian C. Smith, vice-president, and Mr. W. S. Hart, treasurer of Shawinigan, secretary-treasurer. The authorized capital is $600,000.

Wiring a Seven-room Frame Building

Detailed Description of the Procedure—A Complete Installation Without Disfiguring the Walls—$3 an Outlet Allows Good Profit

By Terrell Croft*

It is the object of the writer to describe in detail the procedure followed and the methods used in the recent wiring of a seven-room frame residence that was erected about twelve years ago. The floor plans of the building are shown in the accompanying illustrations. While there is nothing particularly novel in the installation, it is typical of many that are now being made throughout this country and of a great many more that must be made before the field that is now available to the central stations is saturated.

The desideratum in this instance, as is frequently the case with frame buildings of the type illustrated, was to get a fairly good electric-lighting system in the house. It was piped for gas when built, but the owner had difficulty in renting it without electric lighting. He put in the simplest possible electric outfit and omitted all frills.

It was decided to install flush wall switches only in the principal rooms. The living-room, library and dining-room were to be provided with pull-socket fixtures. The two hall lamp outlets, one upstairs and one downstairs, were to be controlled by two flush three-way switches, one in the first-storey hall and the other in the second storey at the head of the stairs. For the cellar one porcelain key socket was to be provided, controlled by a surface wall switch in the cellar stair entry. A porch lamp, baseboard outlets and the like were omitted to minimize cost; but provision was made for ultimately placing them with little difficulty provided that conditions necessitated their installation.

Figs. 1, 2, and 3 show respectively floor plans of the basement and first and second floors. Fig. 4 is an isometric view and delineates the arrangement of the entire installation. This illustration is not quite correct in certain minor particulars, which will be indicated later, because it could not be made strictly accurate without confusing complications in drawing.

In an installation of this kind before any actual work is done the first step should be to make a survey of the premises. The "lay" of the floor beams and partitions should be noted and the wireman should, if possible, plan the run for every wire before he makes any openings in exposed places and

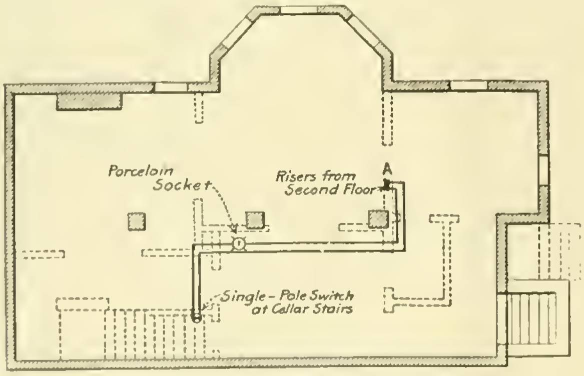


Fig. 1—Plan of basement.

before he locates his entrance. The cellar and the attic should be visited and all of the closets inspected. By thus carefully analyzing a building it is frequently possible to economize in labor and material. Sometimes a raceway, built for pipes or due to some builder's freak, can be located extending from basement to attic and which will accommodate the risers. Horizontal paths may frequently be similarly located. It may be necessary to bore some holes in the attic or cellar and to remove a few boards in closets or in other unexposed locations and to probe with a fish wire to determine the most suitable routes for the wiring. In any case no holes for switch boxes or electrolier outlets should be made in walls or ceilings until the wireman is reasonably sure that he can get his conductors to them. Some skilful old-building wiremen never make a hole for a switch outlet in a wall until the raceway for the conductor is complete to the

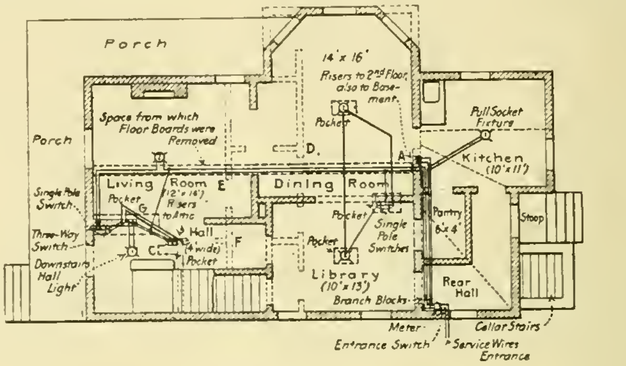


Fig. 2—First floor plan.

switch and a fish chain has been dropped down and sounded within the partition for verification.

In the particular installation being described the first step was to survey the residence carefully. It was discovered by probing with the fish chain (a heavy linen cord having a couple of feet of small chain tied to one end) that a vertical raceway, indicated at A in Figs. 1, 2, and 3, sufficiently large to accommodate several conductors, extended from the basement ceiling to the roof. This was obviously the logical location for the risers. It was found that there were no obstructions in the attic, that it had no floor and that from it the entire ceiling of the second storey could be reached, rendering the installation of the principal part of the work on that floor easy. The floor boards of the second floor ran lengthwise of the building, and enough of them were taken up to indicate that a branch circuit could be readily carried within the first floor ceiling the length of the house, as outlined in Fig. 2, to serve the wiring for the first storey. The selection of the routes for the conductors for the two hall outlets, one on the first and one on the second storey, and for the three-way switches controlling them gave some trouble. Finally, however, after cutting a couple of exploring pockets, one in a closet (B, Fig. 3) and the other in the inconspicuous corner C, the wire route shown was determined.

The general lay-out of the wire routes having been decided upon, the next move was to locate the point of entrance of the conductors into the building and the best location for the meter and the entrance switch. As shown in Figs. 2 and 4, the entrance was made near the rear of the house into the back hall. The local central station company specifies that the interior wiring between the point of entrance and the meter shall be as short as possible and also that the meter be placed where it will be clean and dry and where it can be easily inspected and read. The rear hall location satisfied all of these requirements. The actual arrangement of the equipment about the point of entrance is detailed in Fig. 5. This portion of the job was very quickly placed because the interior of the rear hall had never been finished.

*In Electrical World.

The outside wall at this point consisted merely of clapboarding nailed to 2-in. by 4-in. studs. The loom-incased entrance wires were brought into the hall and to the entrance switch each through a ⅝-in. hole bored through the clapboarding. A vertical cleat was nailed to the face of each of two adjacent studs (see Fig. 5), and to these cleats were spiked two boards. One was for mounting the meter and branch blocks and the other was for the entrance switch. The entrance switch is of the porcelain base, knife-blade type and is pro-

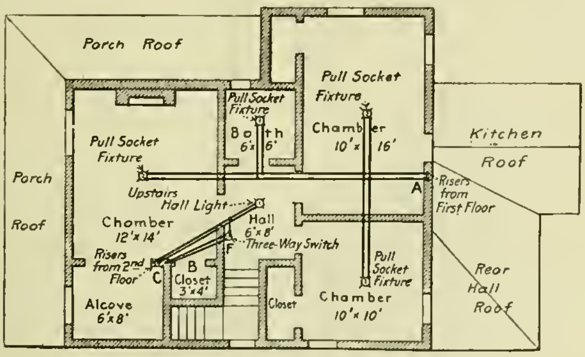


Fig. 3—Second floor plan.

vided with receptacles for Edison plug cut-outs. The retail price of one of 30-amp. rating, the size used, is 50 cents. From the inner side of the entrance switch the conductors pass to the meter and from the meter to the branch blocks, which in this installation constitute the distributing centre. Where there was any possibility of the conductors coming closer together than the minimum distances specified by the Code they were incased in loom. It is cheaper in a confined situation of the sort illustrated in Fig. 5 to cover the conductors entirely with flexible tubing or loom than it is to use loom on part of the wiring and support the rest on porcelain.

Another feature that must be considered before much work is done is the assigning of the different outlets to branch circuits—that is, how many branch circuits should be used and what portion of the building each branch circuit should serve. The Code specifies that there should not be more than sixteen sockets, or, instead, 660 watts of incandescent lamps served by any one cut-out. In the installation under discussion there are exactly sixteen sockets, or, assuming that a 40-watt lamp would be used in each socket, the total load would be 16 x 40 = 640 watts. Evidently it would be possible to connect all of the sockets in the building to

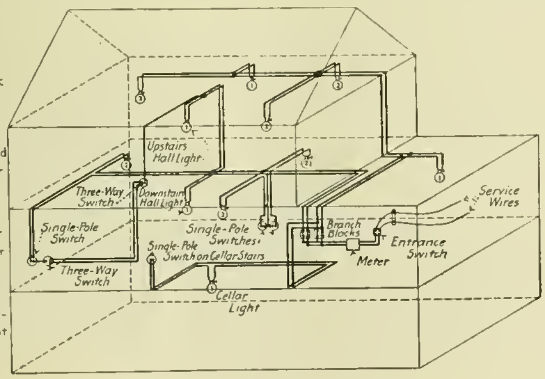


Fig. 4—Isometric plan of wiring.

one branch circuit and yet have the installation meet Code requirements. However, if this were done there would be no means available for outlets that might be added in the future, and the installing of an additional branch circuit after the job had been completed and the floor openings closed would be very expensive. Hence it was decided to provide two branch circuits. One circuit was arranged to feed the second storey and part of the first, and the other most of the first storey.

The cellar lamp outlet was connected to the branch serving the second storey because in the second storey there are seven sockets while in the first storey there are, including the second-storey hall outlet, which must be fed from the first-storey branch, nine. Furthermore, a large proportion of lamps on the first floor are likely to burn at one time, whereas this is not so apt to be true of the lamps on the second floor. The outlet in the kitchen was also connected to the second-storey branch circuit to diminish the load on the first-storey branch.

Ordinary two-wire porcelain Edison-plug cut-outs costing 25 cents each were used for the branch blocks, as indicated in Fig. 5. Edison plug fuses of 10-amp. rating were used for the protection of each wire. Both branch circuits were of No. 14 rubber-covered wire, and No. 10 wire was used from the outside of the building to the entrance switch.

Frequently it is desirable to locate the distribution centre at a point near the centre of the building that is served. In the case being considered this would have cost more and the desirable feature of having the distribution centre near the entrance switch would have been lost.

In installing the wiring for the first floor outlets the first operation was to remove three floor boards the entire length of the building as indicated in Fig. 2. The course of this long "pocket' was so selected that it passed directly over the

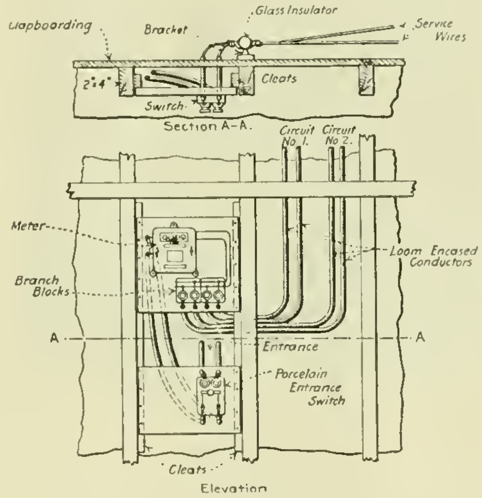


Fig. 5—Service entrance.

living room electrolier outlet, rendering the cutting of a separate pocket for this outlet unnecessary. The pocket passed through the doorway at D but under the partition at E. Pockets were cut over the library and dining-room outlets, and the tap conductors for them were readily fished between the joists to the branch conductors in the long pocket. These branch conductors extending the length of the building within the second-storey floor were threaded through tubes resting in holes in the joists. The tap conductors to the outlets were supported on porcelain knobs held to the faces of the joists with nails driven through leather washers and then into the knobs. For carrying the wires to the two single-pole flush switches for the library and dining-room outlets respectively it was necessary to cut a pocket over the partition between the dining-room and the library. The conductors were carried down within the partition in circular loom. The outlet for the living-room electrolier was wired from the long pocket and its single-pole flush switch was wired by cutting a pocket over the partition between the hall and the living-room. The method of getting the conductors to the hall outlets and to the three-way switches controlling them will be described later.

All of the wiring for the second-floor outlets, with the exception of that for the hall lamp, was placed with little difficulty. One of the branch circuits from the distribution

centre was continued as a riser from the point A (Fig. 2) in the first story ceiling to point A (Fig. 3) in the attic over the second storey. Then the branch was extended horizontally almost the length of the building—far enough to tap the outlet for the front chamber. In the attic the conductors were supported on the upper edges of the joists on split porcelain knobs held in position with nails. The attic could be entered by a trap door in the bathroom ceiling, and there was ample space in it for the wireman to move about and do his work.

Although the method of wiring for the hall outlets and of connecting the two three-way switches controlling them is shown in the floor plans and in the isometric view, it is better illustrated in the detail of Fig. 6. It will be noted from a study of the floor plans that it was not feasible to route the conductors required for these lamps and switches along as short a path as would have been possible with a job in a building under erection. An inspection of the construction of the residence disclosed that the most economical wiring would be as suggested in Fig. 6. The conductors for the first-storey three-way were carried down from the ceiling within the partition incased in circular loom. Then all of the conductors were carried, incased in loom, within another partition between the second-storey floor and its ceiling (Figs. 2, 3, and 6), and then the three conductors for

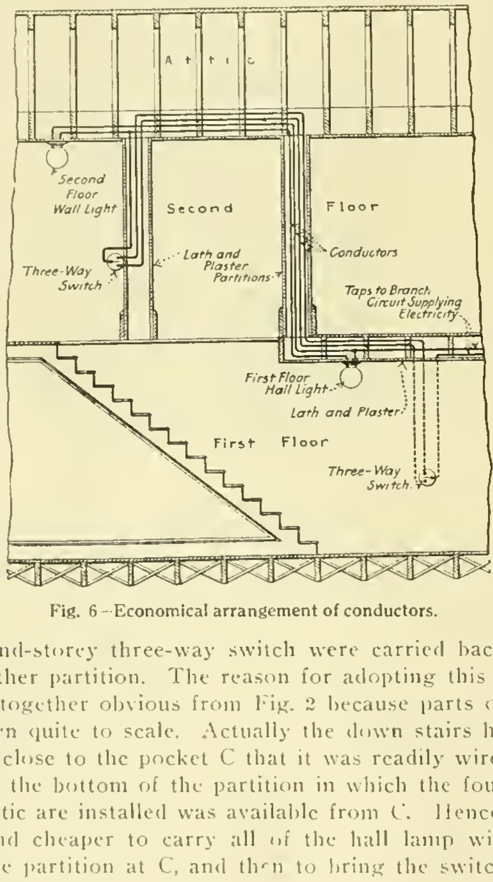


Fig. 6—Economical arrangement of conductors.

the second-storey three-way switch were carried back down still another partition. The reason for adopting this routing is not altogether obvious from Fig. 2 because parts of it are not drawn quite to scale. Actually the down stairs hall outlet is so close to the pocket C that it was readily wired from C. Also the bottom of the partition in which the four risers to the attic are installed was available from C. Hence it was easier and cheaper to carry all of the hall lamp wiring up inside the partition at C, and then to bring the switch wires back again in partition F, than it was to carry the conductors over to F within the first-storey ceiling, which would necessitate cutting another pocket in the second-storey floor under F and the removal of more floor boards. The conductors for the hall wiring were incased in circular loom within the partitions. In ceiling spaces they were carried by knobs and tubes, and in the attic they were supported on porcelain split knobs nailed to the joists.

For illuminating the cellar only one porcelain socket was installed in the beginning. It was placed midway between the furnace and the coal bin. The tap circuit for the cellar outlet was connected to its branch at the point A (Fig. 2) in the little attic over the kitchen, and the riser was dropped down within the partition A to the cellar, where the tap was carried to the socket and to the surface wall switch in the cellar stairway, as indicated in the basement wiring plan (Fig. 1). As previously suggested, the cellar lamp was connected to the upstairs branch circuit. The connection was effected at the point A (Fig. 2) because there was a straight runway, left by the house builder, direct to the cellar from this point. This route could be followed without any boring or cutting, hence the loom-incased risers were drawn into it. In the cellar the wires were run at right angles to the joists and threaded through holes that were bushed with porcelain tubes. Where running parallel to the joists the wires were supported by split knobs nailed to the joist faces. Where the conductors were carried up within the partition to the surface wall switch they were incased in loom.

The isometric view of Fig. 4 is included to give a general idea of how the wiring for the entire installation was routed and of how it was connected. However, the basement branch circuit actually connects to the second-storey branch circuit near the point where the kitchen outlet taps off, instead of at the branch block as shown by the drawing. The routing for the wiring for the hall lamps and their switches is actually arranged as shown in the floor plans and in Fig. 6, instead of as indicated in the isometric view, although the circuit of the isometric view is correct.

The installation was made by a local electrical contractor. His price for roughing in—that is, for the job complete with switches but without fixtures—was $48. This is at the rate of $3 an outlet, counting each switch and lighting fixture position as an outlet. The work required the time of a wireman and one helper for two days and netted a comfortable profit for the contractor.

Personals

Mr Wills Maclachlan has resigned his position with the Electric Power Company and is now inspector for the Electrical Employers' Association of Ontario, with headquarters at 10 Adelaide Street East, Toronto.

Mr. W. W. Chisholm has been appointed electrical engineer of the Windsor, Essex and Lake Shore Rapid Railway, succeeding the late Mr. A. W. Westman. Mr. Chisholm has been, since November, 1907, chief engineer of the power plant of the Windsor, Essex and Lake Shore Rapid Railway.

Mr. W. J. Doherty, Northern Electric Company, Limited, Montreal, has been appointed to the office of Chiron, 13th Congress, of the Jovian Order. Messrs. S. W. Smith and Charles Ellis have been appointed Tribunes of the Montreal Chapter of the Order.

Mr. W. G. Merowit, power apparatus sales, Northern Electric Company, Limited, presented a paper on the function and sales talking points of circuit breakers and oil switches, before the Montreal Jovian League. He brought out the points that affect the sale of this material and what the purchaser should look for in good designs.

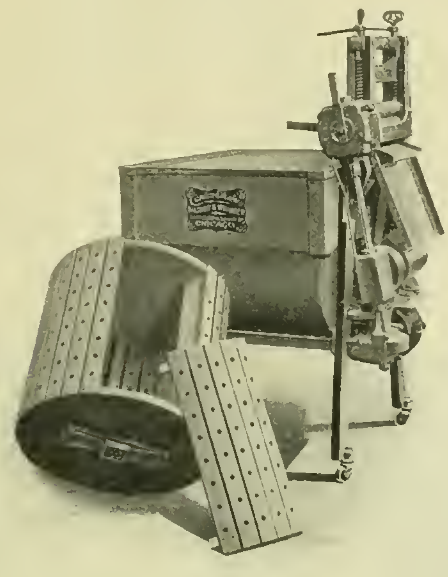
The Alberta Government is now rebuilding its telephone line in the town of Wetaskewin, and owing to new regulations which went into effect lately, it is said the power department of the town will have to rebuild practically all its distribution system. This will involve an expenditure of some $8,000. For this sum all work can be done in accord with the most approved standards.

Mr. G. R. Macleod, railways engineer of the Montreal Council, has made a special report on the tramways system. He states that additional and improved facilities are needed, both for the satisfactory handling of street car traffic and general street traffic, particularly in the more central thoroughfares of the city. Mr. Macleod is against the operation of motor buses, and suggests the building of several sub ways.

What Is New In Electrical Apparatus

Northern Electric—Conlon Washer

The cut shown herewith illustrates the new Northern Electric Conlon Washing Machine, which we described in some detail in the January 15th issue of the Electrical News, page 43. This is a very simple machine, yet strongly designed. It is operated by electric motor directly connect-

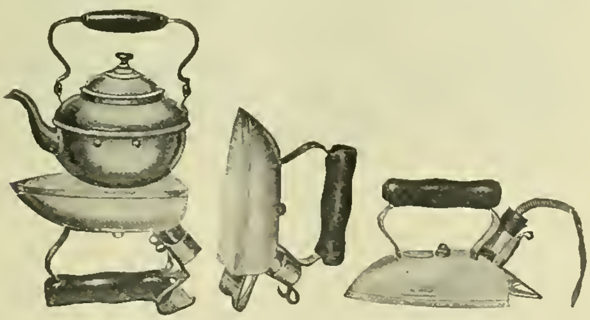


Motor direct-connected to washer.

ed to the washing mechanism, thus ensuring the highest possible efficiency. Special attention is drawn to the small space occupied by these washing machines, rendering them specially suitable for apartment houses and smaller sized residences.

"Canadian Beauty" Irons

The new detachable and reversible back stand, as supplied with "Canadian Beauty" electric irons, is here illustrated. It shows the iron sitting flat as used when ironing, and that the stand allows the iron to work freely. Another position shows how easily the operator can tilt the iron back

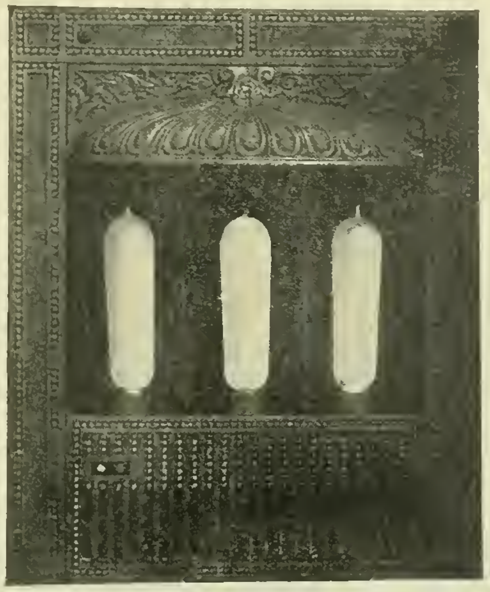


An iron with detachable and reversible back stand.

when changing the article being ironed, or when called away from work for a moment. It raises the iron about 2 ins. from the board or pad. The other position shows how easily the stand can be reversed, thus enabling the operator to change the iron into a hot plate for heating a small kettle of water, brewing tea, heating baby's milk, etc. It is easily put on and removed. The "Canadian Beauty" is manufactured by the Renfrew Electric Manufacturing Company, Renfrew, Ont.

Mantel Type Radiators

The old-time evenings by the fireplace have given way before the advance of civilization and modern conveniences, but are about to return to us. After having discarded the log fire for the more convenient modern heating systems, the true comfort lover again has the pleasure of the fireplace available without its attendant discomforts by means of the most convenient form of heating—electric radiators. A complete line of luminous radiators for use in the mantel place is being marketed by the Westinghouse Electric and Manufacturing Company. These radiators range in size from



A handsome mantel type radiator.

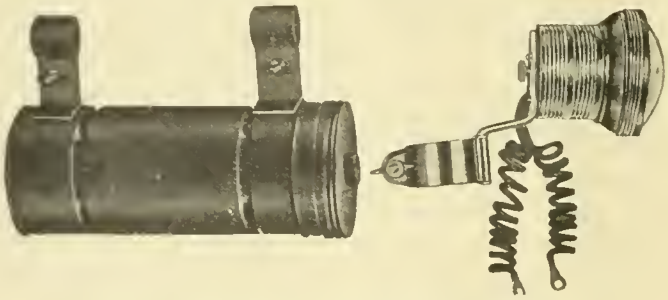
15½ by 18 inches to 30 by 30 inches, several artistic designs being available in each size. The radiators use from two to four luminous heating units each, each heating unit requiring 250 watts. The radiators are adapted for intermittent service, particularly useful for removing the chill before or after the regular heating system is in use. Their safety from danger of fire or fumes makes them ideal for nurseries, bathrooms, reception halls and similar enclosures. Each radiator consists of a handsomely finished ornamental front with polished brass, antique brass, oxidized copper, or practically any electro-plating finish desired. Bathroom radiators are finished only in polished nickel.

New York to San Francisco

On January 26th, telephone connection was accomplished between New York City and San Francisco. As a matter of fact, President Theodore N. Vail spoke from Jeckyl Island approximately 1,000 miles down the coast to San Francisco over a 4,400 mile line, which, with a metallic return meant a complete circuit of 8,800 miles. Dr. Alexander Graham Bell, the great Brantford, Ontario, inventor, spoke from New York to his friend and associate Thos. A. Watson, in San Francisco. It was these two men who, thirty-eight years ago, spoke over the first long distance line, installed by Dr. Bell. This line was two miles long and conversation over that distance was considered a wonderful triumph of science. Dr. Bell is said to predict conversation with the European continent at no very distant date.

Pract-El-Lite

The Central Telephone & Electric Company, 210 North 11th Street, St. Louis, Mo., is now offering the trade a new electrical device called the Pract-El-Lite bicycle lamp. Like the several electric hand lanterns now on the market, this

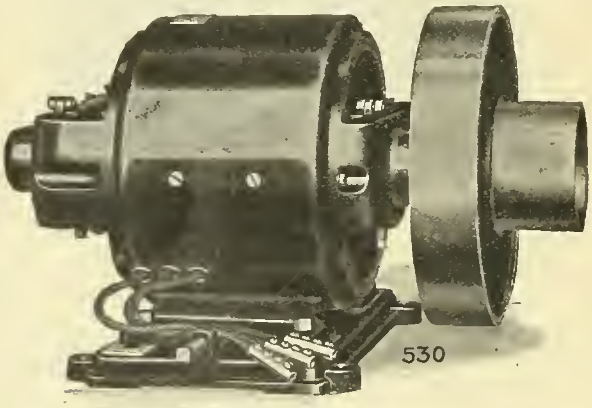


Pract-El-Lite bicycle lamp.

lamp is lighted by means of a dry battery which is clamped to the top bar of the bicycle frame. This contrivance can also be used on motor-cycles and all kinds of wagons.

New Steel Frame Direct Current Generator

The illustration shows a new generator recently introduced by The Robbins & Myers Company, Springfield, O. This generator has a cast steel frame which makes a light, compact construction. It is made in capacities ranging from .24 to 1.5 kilowatts. These generators are furnished in low voltages for charging storage batteries as well as in the higher voltages, and are particularly suitable for farm lighting plant and similar services. They can be supplied with fly



New Robbins & Myers generator.

wheel pulleys as shown in the illustration, for gasoline engine drive. The bearing bracket on the commutator end is so constructed as to give easy access to the commutator and brushes. The bearings are large and are provided with oil reservoirs of large capacity. They are oil ring lubricated. The leads are brought out through holes in the frame which are bushed with a high grade, heat-resisting insulating material. Sliding bases are supplied with adjustment screws for adjusting the belt tension.

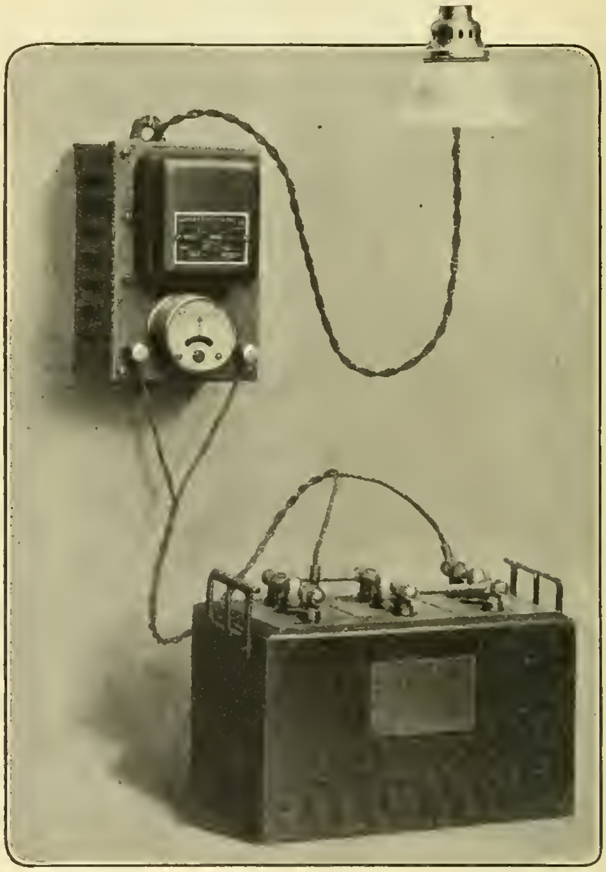
Winnipeg-Transcona Line Delayed

Nothing has yet been done by the Kern interests towards the construction of the proposed car line between Winnipeg and Transcona, due, it is understood, to the indefiniteness of the contract existing between Mr. Kern and the town of Transcona. With a view to clearing up this dispute, an investigation was begun on February 2nd by Public Utilities Commissioner Robson at which representatives of both J. H. Kern and the town of Transcona will be heard.

Rectifier for Electric Automobiles

The illustration herewith represents one of the numerous sizes of alternating current rectifier manufactured by the Wagner Electric Manufacturing Company, of St. Louis, Mo. These are specially designed for use in connection with storage battery automobiles and are made in d.c. capacities up to 15 amperes at 10 volts and 7½ amperes at 12 volts.

A small alternating-current transformer, a part of the rectifier, changes the voltage from the lighting supply mains (about 110 volts) to the proper voltage for the battery. The rectifier proper consists of an electromagnet, the armature of which is a flat spring held rigidly at one end but free at the other to vibrate in front of the core of the magnet. The magnet is so connected that it attracts the armature once for every cycle of the supply frequency, and at each attraction a contact is made which allows part of the alternating-current wave to go through the battery. If connection were continued through the reverse current wave, the battery would discharge. The rectifier armature, however, is released at the instant that the voltage of the battery equals the voltage of the alternating wave, so that the battery cannot discharge by allowing the reverse wave to flow through.



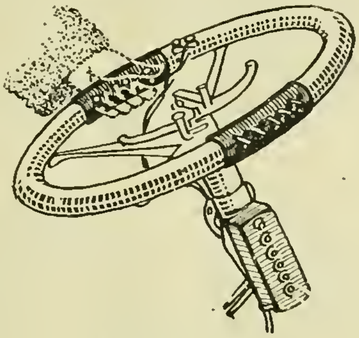
Wagner alternating current rectifier.

The rectifier armature, therefore, traps, so to speak, a part of each similar half of the alternating current wave and stores it in the battery. The current taken by the rectifier, in the smaller sizes, is not more than that taken by an ordinary 16 candle-power lamp, and even in the larger sizes, the current taken from the lamp socket is not sufficient to damage the fixture wiring.

This rectifier may be carried on the automobile when on tour and thus be ready for use wherever a.c. current of approximately 110 volts is available.

Electrically Heated Grip for Steering Wheel

Electrically heated leather-covered grips for use on steering wheels of automobiles have been developed by the Interstate Electric Company, New Orleans, La. The grips are attached to the wheel, as shown in the accompanying il-

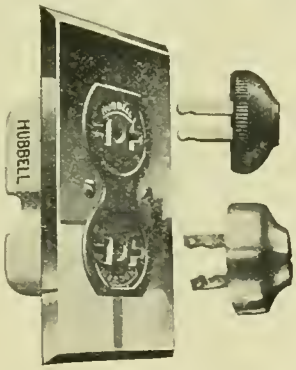


Electrically heated grips.

lustration, and are provided with laces for making them tight. Energy may be obtained from the storage battery of the car or, if the magneto's rating is high enough, from the magneto.

Duplex Flush Receptacle

The illustration herewith represents the Duplex flush receptacle being placed on the market by Harvey Hubbell, Inc., Bridgeport, Conn. The principal advantage of the Duplex receptacle is in the convenience of the additional outlet without the usual expense of the two-gang receptacle. This new receptacle will take any one of an assortment of seventeen different styles of Hubbell plug caps, fitted with



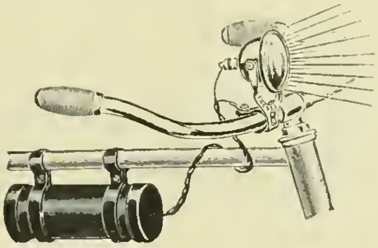
Hubbell duplex receptacle.

either large or small knife blade contacts. These receptacles may also be obtained in gangs. The porcelain base is made extra heavy and lugs supporting the receptacle to the outlet box are of extra heavy brass. One set of binding screws does for both outlets. The first installation of this receptacle is in the new Equitable Building, New York City.

Presto Electric Bicycle Lamp

The various type of flame lamps used as bicycle headlights have frequently been the occasion of serious burns, when the rider has met with an accident resulting in a fall in which he may have come in contact with the highly heated lamp. Flame lamps, moreover, are always a source of possible danger from the liability of igniting gasoline or other inflammable material.

A type of electric bicycle headlamp which eliminates these dangers and at the same time makes for convenience and economy has been placed on the market. It is simple in construction and low in first cost and in upkeep. As shown in the accompanying illustration the lamp with its adjustable reflector body is mounted in a yoke that is clamped to the handle bar. The circuit terminals are connected through a cord to an ordinary No. 6 dry cell which is placed in an enamelled metal container hung from the top bar of the frame. This container has a removable end for the quick insertion of a cell. The connecting cord from the terminals of the cell passes through a bushed opening in one of the ends. By a slight turn of the switch to the right the lamp is lighted and furnishes a steady concentrated light which will illuminate the roadway for a considerable distance ahead of the wheel. The adjustable feature of the lamp permits throwing the light upward or downward through a large angle to suit conditions. This new lamp, known as the

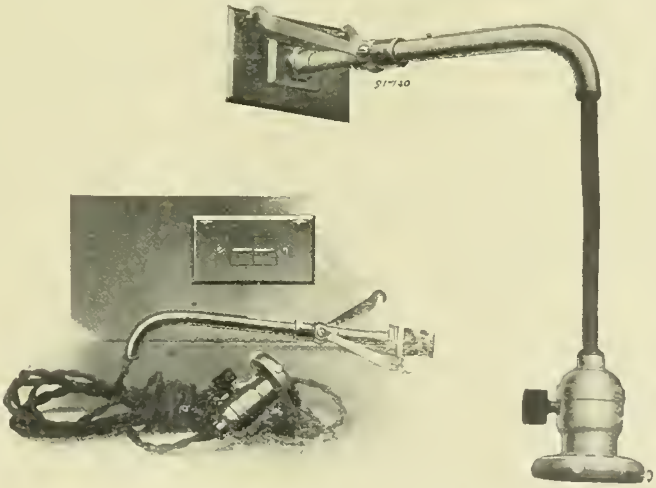


Bicycle lamp with No. 6 dry cell.

Presto Electric Bicycle Lamp, is manufactured by the Metal Specialties Manufacturing Company, 730 West Monroe Street, Chicago, Ill.

Hotel Sample Room Lighting Bracket

This device is the result of a demand on the part of hotel managements for especially effective lighting arrangements in such of their rooms as may be used for the display of samples, and at the same time the ability to remove all evidence of the appliances which bring such rooms under the category of "sample rooms." Around the room, at the height of the picture moulding, are located receptacles of the Bryant disappearing door type equipped with special eyelets to receive the hooks of the bracket. Each receptacle accommodates one bracket Each bracket with its droplight can be removed at will, and the receptacles can be entirely covered up if desired by a hinged section of a picture moulding. A single disappearing door receptacle equipped with special eyelets located over the head of a bed provides for a bed reading



Outfit used in lighting a hotel sample room.

light, with the added advantage that it may be removed whenever the service required of the room makes it desirable. The bracket is shown in the accompanying cut. It is made by the Bryant Electric Company, Bridgeport, Conn.

The privately-owned electric plant in Wallaceburg, Ont., was taken over by the town on February 1st at a purchase price of $36,975. Mr. W. R. Waghorne, superintendent of the company, retains the same position with the town.

Pipe-thawing Transformers

A common way to apply electricity to the thawing of frozen water pipes is to use some transformer that the light company happens to have in stock and control the current by means of a water-barrel or some other home-made resistance. This, of course, will do the work but is decidedly inconvenient and wasteful of power. A better method requires a special choking coil in connection with the transformer. This is more convenient and not so wasteful of power but is not flexible enough to meet the various demands.

The Moloney Electric Company of Canada have brought out a special transformer for this work. It is self-contained and as easily handled as the ordinary transformer. A special arrangement of primary taps and secondary connections permits a great range of secondary voltages. The secondary connections can all be made on a special terminal board outside the transformer case. Access to the primary terminal board is provided for by a handhole of ample size in the cover. Primary taps allow a considerable range of secondary voltage but the design is such that the magnetic density is moderate even on the lowest taps. This makes it possible to use the transformer on any tap for several hours continuously without heating the core. The secondary windings are arranged to give 25, 50, or 100 volts with full capacity at each voltage. By means of the primary taps it is possible to get 4 different voltages with each secondary connection. Thus the secondary voltage can be varied from 12½ to 100 in 12 steps. This arrangement will permit of close adjustment to meet any need within the current capacity of the transformer. The proper secondary voltage for the work in hand can be quickly selected and the pipe thawed in the ordinary case before the ordinary water barrel would be assembled. These transformers are intended for connection to 2,200-volt lines and are furnished with cutouts and ammeters if desired. The sizes range from ten to fifty kv.a.

An Attractive Catalogue

Dainty literature cleverly written materially assists in selling, and Messrs. Belling & Company, Edmonton, London, Eng., and Toronto, Ont., specialists in electric heating and labor-savers have appreciated this in issuing one of those charming folders that never fail to influence the woman—or the man for that matter—who determines most things. Belling electric fires embrace every possible variety; there are portable fires, fires for my lady's boudoir; patterns in Adams, Sheraton, Georgian, and other classic designs. There are "strip" patterns, bar-attachments, and factory heaters—even the small yacht and the big ocean liner have not been overlooked. The goods are of that sound workmanship, exquisite finish, and dainty, artistic design for which Messrs. Belling & Company's products are justly famous.

This firm have recently secured large contracts from the British Admiralty, the Post Office and H. M. Office of Works. They have also had the distinction of being favored with repeat orders from more than 300 of the principal municipal, corporation, and electric supply authorities throughout the British Isles, also leading railway companies and the greatest manufacturing concerns of the country.

Belling & Company are now starting an active sales campaign in Canada. Their special representative is Mr. Frank Ritz, 9 Winchester Apartments, Toronto.

The Basters, Jackson Company, 22 College Street, Toronto, announce that they have taken over the control of the Canadian business of "Viking" bell ringing, toy and low voltage transformers, and will carry a complete stock at their Toronto warehouse.

Trade Publications

Silver Voltameter—No. 240 of the scientific papers of the Bureau of Standards, Washington, D.C., entitled "Studies on the Silver Voltameter."

Electric Trucks—Issued by the General Vehicle Company, Inc, Long Island City, N.Y., containing a quantity of useful information on the operation of electric coal trucks.

Air Sander Equipment—Folder being distributed by the Ohio Brass Company, Mansfield, Ohio, describing the O-B air sander equipment for overcoming slippery rails surely and economically.

Terry Turbines—Bulletin No. 19 issued by the Terry Steam Turbine Company, Hartford, Conn., illustrating and describing a variety of centrifugal pumps manufactured by this company.

Line Transformers—Bulletin No. 1,380, by the Pittsburgh Transformer Company, Pittsburgh, Pa., entitled, "Experience with line Transformers," being a reprint of a paper read before the A. I. E. E.

Condulet Suggestions—Booklet issued by the Crouse-Hinds Company of Canada, Limited, Toronto, containing a quantity of useful and suggestive information on condulets, condulet fittings, etc.

Oil Fuse Cut-outs—Bulletin No. 150, issued by the D & W Fuse Company, Providence, R. I., describing and illustrating their new oil fuse cut-outs, which have recently been placed on the market.

Magnet Switch Starters—Descriptive leaflet No. 3767, issued by the Westinghouse Electric & Manufacturing Company, describing magnet switch starters for alternating current motors with squirrel-cage and slip-ring rotors.

Lightning Arresters—Bulletin 45,602 by the Canadian General Electric Company, illustrating and describing lightning arresters for series lighting circuits. Also bulletin No. 12,300, illustrating and describing steam engine driven generating sets, 2½ to 40 kw.

High-Tension Equipment—Bulletin No. 15 by the Delta-Star Electric Company, Chicago, describing with profuse illustrations their "Unit Type" high-tension indoor equipment comprising a complete line of switches, fuses, choke coils, entrances, etc. This bulletin also contains an appendix called the "Technical Data Section," which includes a quantity of useful information.

Iron Clad Switches—Folder 1 issued by J. H. Tucker & Company, Birmingham, England, describing a new 25-ampere iron-clad switch. In addition to the more usual quick "break," this switch is also fitted with a quick "make" movement. Only micanite is used for insulation. Each switch is subjected to a flash-over test of 2,000 volts. Every case is fitted with an earthing terminal of the size recommended by the I. E. E. The interiors are coated with a special silicate enamel and the exteriors are enamelled and stoved at a high temperature to a hard and high-class finish. The switch is being produced only in the 25-amp. size at present, but other sizes are on the way.

Wallaceburg's Hydro Rates

The new rates to be charged by the Hydro-electric Commission will be 3 cents per 100 sq. ft. of floor area, with a minimum of 1,000 and a maximum of 3,000. The primary meter rent is 5 cents per kw.h. with graduation according to the established scale. Ten per cent. allowed for discount. The commercial lighting rate is 10 cents per kw.h. for the first 30 hours of installed capacity with 5 cents per kw.h. in excess of this amount.

Niagara power was turned on at Lucan on January 22nd.

Current News and Notes

Hamilton, Ont.

Chairman Ellis, of the Hamilton Hydro-electric Power Commission, stated recently that a by-law would be submitted to the ratepayers asking authority to raise funds to establish a hydro-electric telephone system to compete with the Bell Telephone Company.

The steam system of operation of the Wentworth Street Mountain Incline Railway has been replaced by hydro-electric power supplied by the municipality of Hamilton. A storage battery has also been installed for emergency purposes.

It is reported that a telephone system between the different fire stations will be installed in the near future.

Huntsville, Ont.

Huntsville has passed a by-law authorizing the necessary expenditure for a hydro-electric plant on the Muskoka River.

Ilderton, Ont.

The village of Ilderton, ten miles north of London, recently carried an enabling by-law by which the council is authorized to negotiate with the Hydro-electric Power Commission of Ontario for a supply of power.

Kingston, Ont.

No agreement has yet been made between Mr. Campbell of the Gananoque Electric Company and the city of Kingston. The price offered by the city is understood to be .6 cents, and Mr. Campbell's figure is .75 cents per kw.h. Negotiations have been carried on by the Hydro-electric Power Commission of Ontario, and it is considered likely that the contract will be closed at the higher rate, as the Commission could not be in a position to supply Kingston for a considerable period.

London, Ont.

Speaking in London recently, at a banquet given by the Industrial Bureau, Sir Adam Beck spoke on the Hydro Radial project and predicted that Ontario would, in the near future, have a thousand miles of public-owned electric road that would pay their way from the day they started operation.

It is stated that the London Hydro-electric Commission have received word from the Dominion Government to proceed with the installation of municipal lighting equipment in all the Dominion Government buildings in the city.

Montreal, Que.

The superintendent will submit to the City Council shortly his estimates for street lighting on St. Catherine and Bleury Streets. The estimates call for 200 ornamental single lamp standards, and it is understood that if the council votes the necessary funds, work will be started in the near future.

At the monthly meeting of the Montreal Electrical Society Mr. L. E. Hamilton read a paper descriptive of the police signal system just installed at Outremont, P.Q., by the Northern Electric Company, Limited.

Newmarket, Ont.

A by-law will be submitted on February 22nd authorizing an agreement with the Toronto and York Radial Railway Company to supply power; also authorizing the expenditure of $15,000 in connection therewith.

Ottawa, Ont.

The Ottawa Electric & Gas Club celebrated the opening of their new Club Rooms on Thursday evening, January 21st, by a bumper meeting, attended by one hundred and twenty-six members. The President, Mr. W. H. McIntyre, was in the chair.

Quebec, P.Q.

The Quebec Government at the suggestion of the Quebec Streams Commission, have prepared a Bill regarding the building of a storage dam on the St. Francis River. This is for the purpose of giving a constant supply of water to the various electrical plants, mainly for lumber and pulp industries, on this river.

It is reported that the Dorchester Electric Company has been taken over by the Shawinigan Light & Power Company, and that a transmission line will be constructed from Shawinigan to Quebec to serve the customers of the local company. The steam plant of the Dorchester Electric Company will remain a useful asset as an auxiliary.

St. Thomas, Ont.

The Separate School Board have decided to equip St. Joseph's Convent electrically. The contract for wiring has been awarded to Mr. C. W. Howkins.

Mr. Geo. W. House has been appointed by the Hydro-electric Power Commission as electrical inspector for St. Thomas, Ont.

Toronto, Ont.

The Forest Hill Electric Railway Company are making application at the next session of the Ontario Legislature for an extension of time until 1917 for the commencement of their railway line.

The Humber Valley Electric Railway Company are asking the local legislature for an indefinite extension of time in which to start and complete their electric railway.

The Suburban Electric Railway Company are seeking permission of the local legislature to operate their cars on Sunday.

The Toronto and York Radial Railway Company are making a request to the legislature to be allowed to lay and operate a double track system on Yonge Street within the city limits.

The Toronto Lacrosse and Athletic Association are taking steps to have a by-law introduced asking that the city construct and operate a municipal line in Rosedale, connecting the present northern limits of the Church Street line with the Lacrosse Grounds.

The Board of Control have decided to ask the legislature to cancel the franchise, within the city limits, of the Toronto Suburban Railway Company.

The City Council will oppose the application of the Toronto & York Radial Railway Company for a double track on Yonge Street.

The new double circuit line of the Hydro-electric Power Commission of Ontario connecting Niagara Falls with Dundas, has been completed and operation was commenced during the first week in February.

The announcement was recently made that the total consumption of the area served by the Hydro-electric Power Commission of Ontario has reached the total of 92,000 h.p. It was further predicted by the chairman of the Commission that before March 1st, 1915, this figure would reach 100,000.

Thamesville, Ont.

Plans are under way to introduce hydro-electric power into Thamesville, Ont. The Commission have quoted a rate of $48 per h.p. year.

Condensed Department

Publisher's Notice

Advertisements under "Situation Wanted" "Situation Vacant" or Miscellaneous, are charged at two cents a word per insertion, minimum charge 50 cents.

Advertisements for tenders, equipment, wanted or for sale, etc., are charged at $2.10 per inch.

All advertisements must be in the publisher's hands by the 10th or 23rd of the month to insure insertion in the subsequent issue.

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No tender necessarily accepted.

M. A. DICKINSON,
Acting Clerk.

Windsor, Ont., Feb. 9, 1915 4

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Vol. 24 Toronto, March 1, 1915 No. 5

Electrical Markets of the World

There is no country in the world more favorably endowed by Providence, or more adequately supplied with raw materials and the means of converting these into finished products than is the Dominion of Canada. This applies within very wide limits to electrical goods and accessories of almost every sort, yet Canada is not world famous as a manufacturing country. We do not even manufacture many of the things we need and buy ourselves, and our exports (speaking now of the electrical trade) are almost negligible.

The stock argument with which we are invariably confronted is that the Canadian demand is not sufficient to justify the establishment of factories in Canada. Why do we accept this argument as final? What is it that determines the nature and number of manufactured products in any locality? Is it local demand? Is it not rather local conditions and resources, such as raw material, power, labor, etc.? For example, is Germany known as the world's greatest producer of electric lamps, because the German market for lamps is greater than that of any other country? Surely not. It is because local manufacturing conditions favor economical production. Is Australia chiefly known as a wool-producing country because of great local requirements? What made Pittsburgh the great manufacturing city it is to-day,—local requirements or local resources?

In fact, history shows that the local demands of a country play a very secondary part in determining its manufactured products. This, then, would seem to dispose of the argument that Canada cannot afford to manufacture because Canadian requirements are limited. Are not the markets of the world as open to the Canadian manufactured articles as to the products of other countries?

There are different factors we must always remember, in our "Made-at-Home" cry. There are certain things which Canada undoubtedly is not in a favorable position to manufacture, and these she must continue to import for all time. On the other hand, there are many products that may be turned out economically in Canada in such quantities as to supply the demands of many other countries, in addition to our home market. So that a partial condition of reciprocity must, of necessity, always exist. Any attempt to override these natural conditions must only result in unduly high costs to the home consumer without any chance of compensation by an increase in export trade.

If Canada is going to be any considerable factor in world commerce she has got to increase greatly the number and variety of her factories—but not necessarily along the line of home requirements. Now is the time to lay the foundation of this new structure. More than one of the chief producers of the world are crippled in their manufacturing capacity, as well as in their power to make deliveries, and a wide field is thus opened to the factories of the rest of the world. The United States, with their habitual instinct, have already scented these new foreign dollars. England, we hope and believe, is fully awake, but is, of course, greatly occupied with other and more immediately important matters. What of Canada? Who among us has a sufficiently clear vision of the things we can manufacture and do not; and of the things other countries want and cannot themselves supply?

In this issue we have endeavored to give our readers a superficial idea at least of the condition of world commerce in regard to electrical matters. We quote figures showing Germany's and Austria's exports and their markets. These figures indicate that the fields now left unsupplied by these countries are very wide. They are open to the world, and, other things being equal, the early bird will, as in the past, get the fattest worms. Figures given in the same article also show that Canada's exports of electrical equipment are very small indeed. This is a matter much more urgent of remedy than the fact that our imports are of fair size. The Canadian market for many years to come must be limited approximately in proportion to her population, but population need place no limit on our production of manufactured articles. That is a matter chiefly of local resources and foreign, not local, demands. We have always had the resources (though we are only just beginning to realize their extent), and now the German nation has unwittingly thrown open the markets of the world to us. Are our governments, our manufacturers' associations and our boards of trade taking advantage of our to-day's unusual opportunities, which, however much we may deplore the cause, it would be folly to fail to take fullest advantage of commercially.

What More Can Canada Produce?

The effect of the recent increase in tariff charges on Canadian electrical imports, on trade "within the Empire," is rather difficult to foresee. To a considerable extent the matter is in the hands of the Canadian manufacturer. If he is satisfied to adhere to the prices quoted up to the present time, it will make our market increasingly difficult for outside manufacturers to do business in, and should consequently be the means of stimulating our home industries. In this case the consumer is fairly treated, our manufacturers gain the advantage of their normal profit on an increased number of sales, but the government coffers are not replenished in proportion.

If, on the other hand, Canadian manufacturers make the increased tariff the occasion of increasing their prices to

the consumer in proportion, the ratio of imported to home manufactured goods used in Canada will probably remain about the same. The consumer will pay the added cost, the manufacturer will profit to the extent that the consumer loses on home manufactured goods, and the government will get its proportionate increase in tariffs which also will come out of the consumer. Home industries will not be stimulated to any extent, however.

In lines not now manufactured in Canada, the natural tendency of the increased tariff will be to encourage the establishment of new industries. This in itself is much to be desired. There are many things we can manufacture in Canada as a result of our varied resources, but we do not seem to be able yet to grasp the idea of foreign markets for our goods—especially in electrical matters; this is shown by the small total of our electrical exports. Now, when many markets at different points all over the world are forced to look for new sources of supplies, Canada will do well to make a bid for the business.

Elsewhere in this issue we print a number of letters from men prominently connected with the electrical trade in Canada, which contain valuable suggestions as to what Canada might further produce in the way of manufactured articles. These letters have been written, too, having chiefly in mind the home demand. If the broader questions of export and foreign demand had been considered, there is no doubt the list would have been vastly increased, and, as well, added force would have been given to suggestions actually made. One cannot but be impressed, however, with the fact that there is so little uniformity in these suggestions, which indicates that if this matter should receive proper and extended consideration, the number of products we would find we can manufacture would assume tremendous proportions. We commend these letters to our readers, to our financial men, to our manufacturers. They contain hints and suggestions from men who speak through experience and which may well form the basis of a much broader manufacturing policy than Canada has pursued in the past.

New Niagara-Dundas Line

The Hydro-electric Power Commission of Ontario recently placed in operation their new double circuit tower line between Niagara Falls and Toronto. Some time ago when some little difficulty developed in the insulators on this line, the matter of establishing auxiliary steam plants was discussed, but it was considered wiser in the interests of continuity of service throughout the system to duplicate the transmission line over the main part of the system. The Commission now has four circuits connecting Niagara Falls with Dundas, that part of the whole system which is most liable to electrical disturbance, and it would appear to be extremely unlikely that all four of these lines will be put out at the same time. Aside, also, from constituting an added insurance of a continuity of service to the people of Ontario, these lines have doubled the capacity of the system, which seems very necessary in the light of recent announcements by the chairman of the Provincial Commission that the peak load has already very closely approached the maximum of 100,000 h.p. for which the Provincial contract calls with the Ontario Power Company of Niagara Falls. The tower used on the new line does not differ from that used on the Windsor extension, which was described and illustrated in our issue of April 15th, 1914, page 63. These towers are 67 ft. high with three cross arms strongly braced, the upper one also carrying two steel wires for lightning protection purposes. The two circuits are placed one on each side of the tower in tandem arrangement. The lowest cross arm of the tower is 20 ft. 2 in. from tip to tip, the upper arms being slightly shorter. The insulator units are practically identical with the original type, the standard insulator containing eight units and the strain insulators two parallel sets of ten units each. A clearance of 9 ft. between conductors on the same circuit is maintained throughout.

The new double circuit is of copper, this being no doubt largely determined by the favorable prices which prevailed for this material at the time the contracts were let. The first line was originally of 4/0 equivalent aluminium, but the Commission has just completed the work of changing this over to 4/0 equivalent steel core aluminium cable. This latter was supplied by the Northern Aluminum Company.

Canada's Power Possibilities

We ask the attention of our readers, especially our overseas cousins, to the illustrations of developed and undeveloped Canadian water powers shown in this issue, and the brief descriptive article which deals with this subject. These views are merely typical and far from complete. As regards the undeveloped powers, our illustrations, of course, represent the merest fraction of the sum total. We point to these with considerable pride and in the belief that few countries in the world, if any, could make a more formidable showing in the way of large units and large capacity developments and power sites.

Industries and Cheap Power

In investigating the relative requirements of the different industries which should thrive and which, therefore, should be encouraged in Canada, one may follow different lines of reasoning. One train of thought naturally makes us turn to the benefits to be derived from our large water-powers now still unused. Water-power means cheap power where large amounts and continuous operations are required.

The following table has been prepared by the Commission of Conservation, Canada, from both Canadian and United States census reports and various other sources. It shows the amount of power required, in the different industries enumerated, to produce $1,000 worth of product during one year. The greater this proportion, the greater attraction will cheap power have for this industry.

Industry	H.P. required per $1,000 product per year.
(Data from various sources)	
Nitrates from nitrogen of the air	31.4
Mechanical wood pulp	16.93
Aluminium	16.00
Calcium carbide	15.39
(Data from Canadian census)	
Cement	7.08
Log products	2.95
Brick, tile and pottery	2.28
Iron and steel products	1.98
Cottons	1.97
(Data from U. S. census)	
Cement	5.91
Paper and wood pulp	4.87
Kaolin and ground earth	4.47
Brick and tile	3.67
Grindstones	3.35
Iron and steel, blast furnaces	3.00
Flax and hemp, dressed	2.16
Lumber products	2.46
Cotton goods	2.07

Carborundum requires 5,150 h.p. hours to produce one ton. In the manufacture of nitric acid from the nitrogen of the air, one horse power is required for every 900 lbs. of acid produced in a year. The process of making graphite in electric furnaces also requires a large amount of power.

Canadian Powers—Developed and Latent

A brief and very general review of the situation as regards power possibilities in Canada —Our resources in water falls, coal mines, oil and gas fiields as yet can only be guessed at—Some typical illustrations of our operating hydro-electric plants and of our undeveloped water falls

Even Canadian engineers who have spent many years studying the water power, coal and other resources of Canada, hesitate to name figures which should represent the limit of our potentialities. In the matter of water powers, the Commission of Conservation of Canada some three or four years ago published a report on various water falls at different points, which totalled something over 20,000,000 h.p.; this, too, was without taking into consideration the utilization of proper storage facilities, which would greatly increase the power obtainable. This report has since been shown, as indeed it was anticipated by the Commission at the time of publication it would be, to have been lacking in accuracy at many points. For example, on one of our largest rivers, the Nelson, which the Commission reported as capable of developing something over 6,000,000 h.p., later investigations have shown that this estimate is considerably too high, unless conditions of regulation which it would be expensive to obtain could be brought to bear. On the other hand, in the province of British Columbia, where it is known that some of the largest water power possibilities exist and certainly much the highest heads, the Commission only accounted for 1,000,000 h.p. In the meantime, however, the Commission's engineers have been actively prosecuting their work of investigation at other points of this province, and, though no figures are yet available, it now seems probable that this estimate is many times too small and may not represent more than 10 to 20 per cent. of the total amount of power that will be accounted for when the Commission's work is completed.

In addition, there is a large area across the north of Canada where immense rivers exist, but in connection with which figures have never been obtained, either as to flow or fall; this largely for the reason that, being too far removed as yet from the centres of commerce and so not likely to be required for some years to come, no good purpose could be served by prosecuting the work in the more northern sections until accurate and sufficient information throughout the more thickly populated districts had been secured.

Lage Area to Cover

It must be taken into consideration that the area to be investigated is very large indeed, that the resources of the Commission are far from unlimited and that, inasmuch as the work was only recently undertaken, it will require possibly a number of years yet before we can form any just and accurate idea of the amount of power we could develop, even without taking into consideration the almost equally important question of regulation.

The water falls of Canada are, perhaps unfortunately, not evenly distributed over the Dominion, and there is a large area in the central west, Alberta and Saskatchewan, where no very large sources of power are available except through long distance transmission, requiring higher developments of the art of transmission than have yet been proven feasible. However, all over this area it has now been shown that Canada has immense areas of coal, the province of Alberta being practically underlaid with a good quality of bituminous, which, though not yet of sufficient value to transport great distances, could nevertheless be used to excellent advantage locally in the development of power through steam turbine or other units. Added to this there are being located from time to time available gas and oil wells, all of which add to the already almost unlimited possibilities which Canada appears to possess in the way of material for supplying electric power.

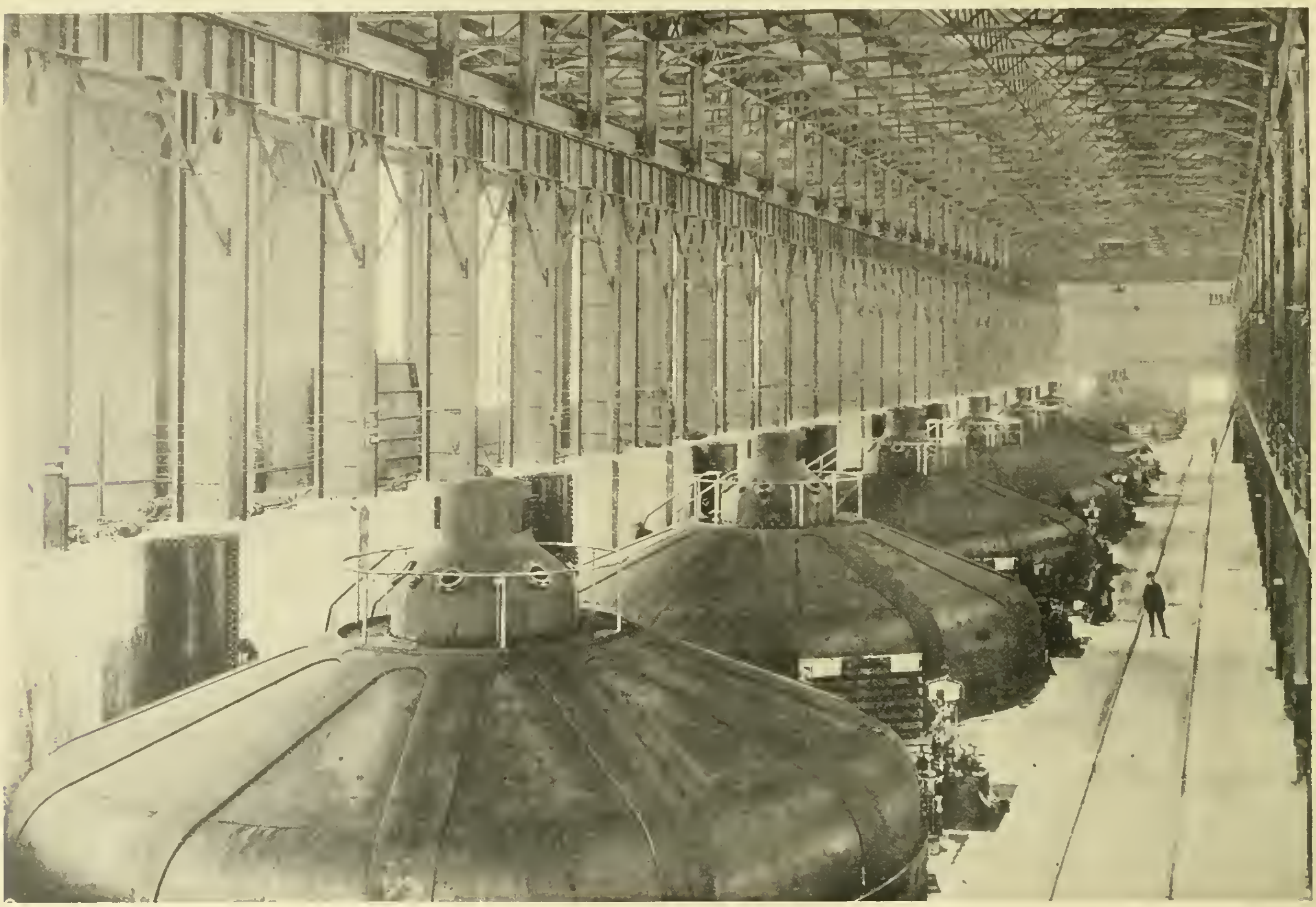
Only a very small percentage of the total water power of Canada has, of course, been developed to date. The sum total, including Niagara Falls, which is the point of most complete development, would probably approximate a million, so that, supposing that at a rough estimate we possess not more than 25,000,000 h.p. in all, and have developed half a million, we are still only utilizing 1/25th of the power possibilities. Our coal areas are scarcely touched, but we may confidently look in the near future for the establishment of large steam turbine plants at different points, where coal can be most economically mined and where there is a market of fair size within transmission distance. A number of such schemes have been discussed for Western Canada, and under normal conditions would probably have been under way before this. Following a revival of trade, which is inevitable in the near futnre, the demand for large quantities of power will become more insistent, and electrical equipment of every sort will be in demand.

Large Developments and Units

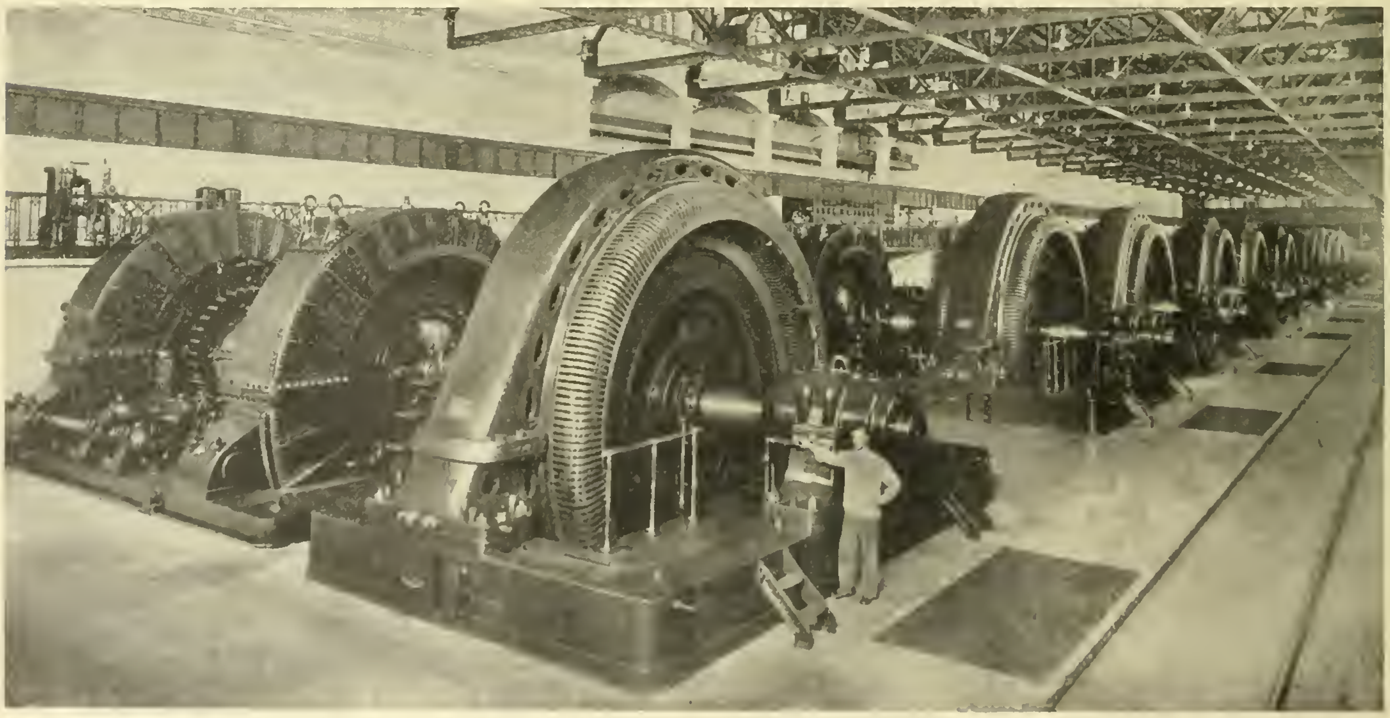
Canada probably possesses in proportion to her population a greater number of large water power developments using large units than any other country in the world. Our plants at Niagara Falls have been described at length in this and other journals, and are widely known. The largest station at Niagara Falls is the Ontario Power Company's plant, which, with their 14 units, illustrated elsewhere, has a total capacity of 170,000 h.p. The Canadian Niagara Power Company, also shown herewith, have installed seven units to date, and have made provision for the addition of four more. The installed capacity of this plant is 75,000 h.p. The Toronto Power Company have installed their full quota of generators, eleven in number, which place them in a position to develop 165,000 h.p. continuously. This makes a total for Niagara Falls at present available of 410,000 h.p.

This large amount of power is developed on the Canadian side at Niagara Falls, and represents practically the limit of development allowed by the Dominion Government at the present time, and all that is considered feasible to develop without interfering with the scenic value of the falls. Unfortunately, Canadian industries were not developed to such an extent, when these plants were installed, that they could absorb all this power, and a considerable percentage of the total is exported to the United States. The seriousness of the power situation from the point of view of the Province of Ontario on this account is unquestioned. The Hydro-electric Power Commission of Ontario, which some five years ago were criticized for contracting for 100,000 h.p. for distribution throughout Ontario, as being a possibility so far removed as to make the contract appear ridiculous, now actually finds itself up against the problem of providing almost immediately for a supply of power in excess of this amount. Several weeks ago it was announced that the peak load of the Commission had reached the total of 92,000 h.p., and it was anticipated that at the rate new municipalities were being added and old customers increasing their requirements, the 100,000 mark would be reached within the next two or three months. With Niagara Falls developed to

Typical Canadian Hydro-Electric Developments

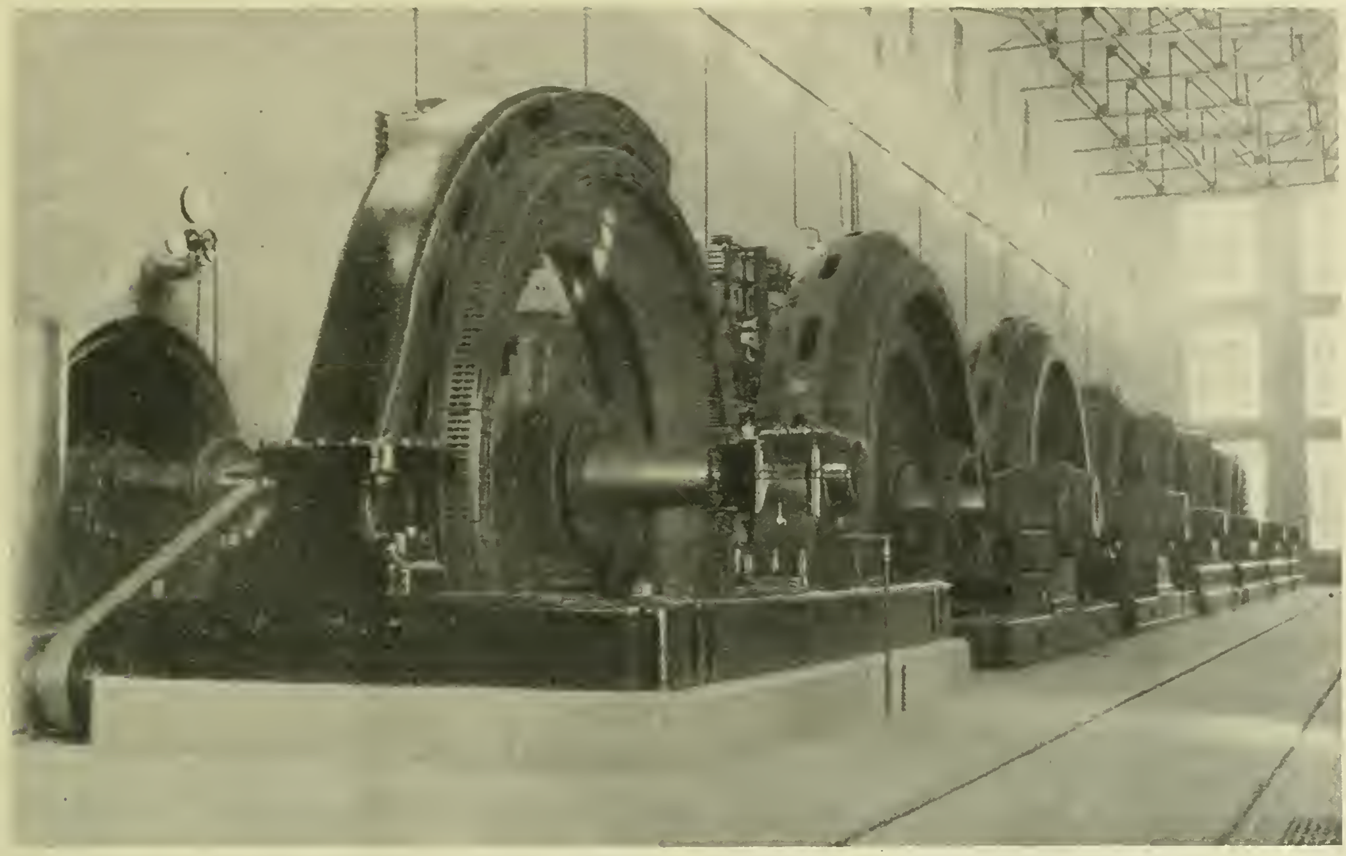


Cedars Rapids Mfg. and Power Co., Montreal. Planned for eighteen 10,000 h.p. units, ten of which are installed. These generators have a diameter of 36 feet, biggest in the world.



Units 1 to 10 inclusive, Ontario Power Co., Niagara Falls, Ont. With units shown on page 48 total capacity of this station is 169,000 h.p.

Typical Canadian Hydro-Electric Developments



City of Winnipeg Municipal Plant, Winnipeg River, Manitoba—Ultimate capacity 90,000 horse power.

Canadian Niagara Power Co., Niagara Falls, Ont. 5 units of 10,000 h.p. each and 2 of 12,000 h.p. each.

capacity and with the surplus power serving established industries in the United States, our government must see to it that the resources of Niagara Falls are carefully husbanded in the future, and that no agreement shall be ratified which will allow of the export of one single horsepower of electrical energy which is not already demanded by existing agreements.

Montreal an Important Power Centre

But Niagara Falls can no longer be considered as pre-eminently the centre of developed power in Canada. At Montreal during the past year there has been constructed a plant by the Cedars Rapids Manufacturing and Power Company, which when completed will develop 160,000 h.p. The initial installation, practically completed at the present moment, consists of ten units, which will have a combined capacity of 100,000 h.p. In addition to this the Shawinigan Water & Power Company, situated a short distance out of Montreal, have just recently completed a new station which has a normal capacity of 90,000 h.p. in five units. Another power house of the same company at the same point, installed previously, has a capacity of 55,000 h.p., making a combined electrical capacity of 145,000 h.p. normally. At this same point there are also large hydraulic developments for certain industrial plants, one of the most important being the Northern Aluminum Company.

There is also, in addition to these two large plants, the very considerable plant of the Canadian Light & Power Company, which develops some 30,000 h.p. on the Beauharnois Canal. These three plants, with smaller ones in the immediate neighborhood, would therefore bring the total of production, with Montreal as the centre, up to approximately 300,000 h.p. at the present moment.

Two Large Plants at Winnipeg

Winnipeg City, Manitoba, promises to be another important power centre. There are at the present time two power plants operating, one by the Winnipeg Electric Railway Company, and the other, illustrated elsewhere in this issue, by, the municipality of the city of Winnipeg. These two water power developments represent probably only about one-fourth of the water power possibilities on the Winnipeg River, located within approximately one hundred miles of Winnipeg,—a reasonable transmission distance. The amount of power that could be supplied to Winnipeg without meeting any insuperable difficulties in the way of installation is about 250,000 h.p. With fair regulation it is calculated this can be increased to 400,000 h.p., and, with maximum regulation, to well over the half million mark.

The Winnipeg Electric Railway power plant is situated fifty-two miles from Winnipeg and is capable of developing about 26,000 h.p. The municipal plant is planned for a capacity of 88,000 h.p., but up to the present only five units of about 5,000 h.p. each have been installed.

Another large plant is situated at Fort William, east of Winnipeg, at Kakabeka Falls, on the Kaministiquia River, and further west we have the Horse Shoe Falls plant and the Kananaskis Falls plant of the Calgary Power Company, the Stave Lake plant of the Western Canada Power Company, the two large hydro-electric plants of the B. C. E. R. Company, and the West Kootenay Power & Light Company. The Kaministiquia Power Company has a total horsepower capacity of 35,000, installed in four units, the last one, just completed, having a capacity of 12,000 h.p. The capacity of the Calgary Power Company is approximately 30,000 h.p., in units varying from 6,000 h.p. down.

The Jordan River Power Company, a subsidiary of the B. C. E. R. Company, just recently completed the installation of a 13,000 h.p. unit in their plant at Jordan River. This plant when complete will contain another unit of this size, in addition to two smaller units of 6,000 h.p. each, which have been operating for some two years. This plant operates under a static head of 1,145 ft. This latter plant is in addition to the parent plant of the B. C. E. R. Company in power houses Nos. 1 and 2 in Burrard Inlet, which have a capacity of approximately 45,000 h.p. each. In addition to this, the B. C. E. R. Co. operates large auxiliary steam turbine plants in connection with both Vancouver and Victoria cities.

The Western Canada Power Company have just completed the installation of their third 13,000 h.p. unit, and are planning the installation of the fourth unit, which will bring their capacity up to approximately 50,000 h.p. This plant is situated some fifty miles from Vancouver city. The Western Canada Power Company also are planning to develop a second site of equal capacity with their first plant, the second plant to be situated a few miles down the river. With the plants of these two companies installed to capacity, Vancouver will be the centre of one of the four Canadian large power districts at present under aggressive development.

In the foregoing we have touched only on the plants of the first magnitude using larger units. In many instances the smaller water falls have been developed because smaller capital expenditure was concerned. The number of generating plants in Canada of the second magnitude, including, say, a total capacity of 10,000 h.p. and under, and utilizing units of 2,000 and 3,000 h.p., may be said to be legion.

Work of Ontario Commission

Even so brief a review as the foregoing on Canada's electrical possibilities would be incomplete without some mention of the developments in transmission line engineering in which Canada has played a prominent part. The two most important of these are probably the distribution system of the Hydro-electric Power Commission of Ontario, and the newest transmission line of the Shawinigan Water & Power Company. The Ontario line operates at 110,000 volts, and the Shawinigan line is constructed for operation at 100,000 volts. The possibilities of long distance transmission have been shown, particularly in the case of the Ontario line, which now stretches from Niagara Falls on the east to Windsor on the west, a distance of some 285 miles. It is interesting to note that the line loss for this great distance has been so carefully considered that no difficulties have been encountered in the way of operation.

Within the last few days, the Commission have completed a duplicate line between Niagara Falls and Dundas, that is, between their step-up station and their main distributing station. This line is approximately 50 miles long and the tower line, of steel construction, carries two circuits of 4/0 copper. The capacity of the new line is almost identical with the first line of the commission, except that a somewhat different route is followed and that copper has been used instead of aluminium. No doubt the copper prices which ruled during the early part of last year played an important part in deciding the engineers to use copper cable. The Commission has also recently completed their work of changing over the original aluminium line to steel core aluminium, so that the four transmission lines, as they now stand, between Niagara Falls and Dundas, are two 4/0 copper equivalent aluminium steel core cables and two of 4/0 copper. Operation of this line has been at 110,000 volts suspended by eight unit type insulators. Aside from certain weaknesses which developed in the insulators a couple of years after they had been placed in operation, and which have now been overcome, and some little troubles which arose as the result of the considerable sag which was necessarily allowed in the original aluminium cables and which has now been remedied by the substitution of steel core aluminium, we understand, this line has been operating with entire satisfaction and giving no more trouble than would normally have been experienced from a much lower voltage transmission system.

Canada's War Contributions

A Brief Review of the Share Canada is Taking in Carrying the Burden of the Mother Country at this Time of Stress and Strain

By Mr. Frederic Nicholls

At present no definite statistical information can be collected which will adequately set forth the full measure of Canada's effort towards carrying her fair share of the burden of the Mother Country during this time of great stress and strain, and probably some of the most important measures of a helpful nature have not been, and cannot be at this time, made public, and must be left to the Historian to set forth, when a history of Canada's share in the European war is fitly chronicled.

What is already known, however, is sufficient to prove that from every point of the Dominion the spontaneous outpourings of our Canadian people, whether directed through Parliament, County and Municipal Councils, voluntary organizations, or by individual effort, have been such as to bring home to us all the thought that we are an important link in the mighty chain that binds the world-wide British Empire together.

Without doubt our greatest contribution to the Empire is the thousands of the best and bravest of our male population who have volunteered for active service in the defence of the British Dominions, and some thirty thousand of whom are now in the firing line in France. No man can give more than his life to a cause, and some eighty thousand brave hearts by volunteering to fight the battles of the Empire have already offered to make this supreme sacrifice, but our ultimate tribute in blood cannot yet be estimated.

As to our contributions in money and goods, few are aware that the cost to Canada of its expenditure for the equipment and maintenance of our troops is upwards of three hundred thousand dollars daily, and the vast sums that are being spent in this way will have to be augmented for at least a generation to come by other sums for the maintenance of the wounded and disabled, and for pensions to the dependents of those who will not return. In addition the Federal Government has incurred expenditures for the purchase of submarines; have provided our allies with over two hundred field and machine guns; have donated the sum of one hundred thousand dollars for the Canadian Hospital in France; fifty thousand dollars to the Belgian Relief Fund; and one million bags of flour to the British Government for the purpose of relieving distress.

What the Federal Government has done, as above set forth, is but an earnest of the sentiment of our people to uncomplainingly assume to the fullest extent their share of responsibility. The several Provincial Legislatures have also undertaken very heavy responsibilities, and collectively have donated in cash or produce the equivalent of several million dollars. Our cities, large and small, have not been backward in well-doing, and have contributed directly in cash, or in the purchase of artillery, machine guns, food, and subscriptions to the Patriotic Fund and for other benevolent purposes, several additional millions to help swell the grand total.

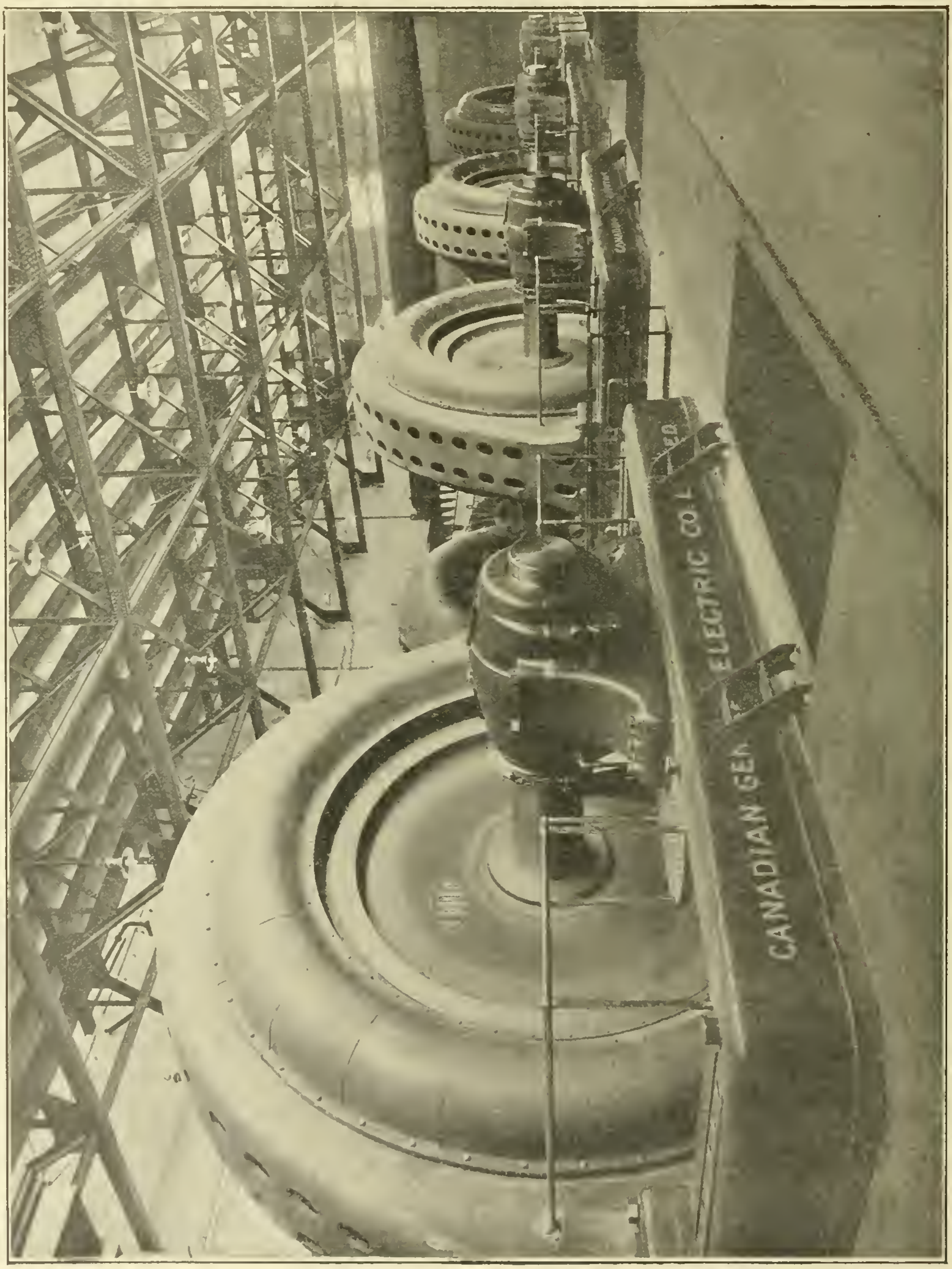
Private effort, however, is the best gauge of our realization of our duty to ourselves and our Empire, and who can estimate the weight of our individual effort to its full measure. We know that millions have been subscribed to the Canadian Patriotic Fund, Canadian Red Cross Society, Belgian Relief Fund, Canadian Women's Hospital, and for the purchase of batteries of machine guns, motor ambulances, and for other purposes. We know that our great financial, industrial, and commercial institutions have subscribed munificently, and that many of our wealthy citizens have given abundantly of their means, but in my judgment the outstanding feature of all is the wonderful manner in which the individual citizens, high and low, male and female, old and young, have rallied to the flag.

The tocsin of war was first sounded in August last, and we then knew to a certainty that England had, as ever, decided to stand for freedom's cause, and from that moment our individual effort has continued, and will continue. Is it not inspiring when we think how well the old adage "Many hands make light work" has been exemplified? Picture the busy hands of hundreds of thousands of Canadian women knitting and sewing, in season and out of season, so that our soldiers may be more comfortable. From the squaw in far-off Alaska to the Cape Breton fisherman's widow, and throughout all the thousands of miles between, the clash of the knitting needle has never ceased since the call to arms, and our women, in this and many other ways, have set a noble example.

The Home Guards, the Boy Scouts, and school children's contributions are only a few more of the many instances that help to swell the volume of great achievement by a united people.

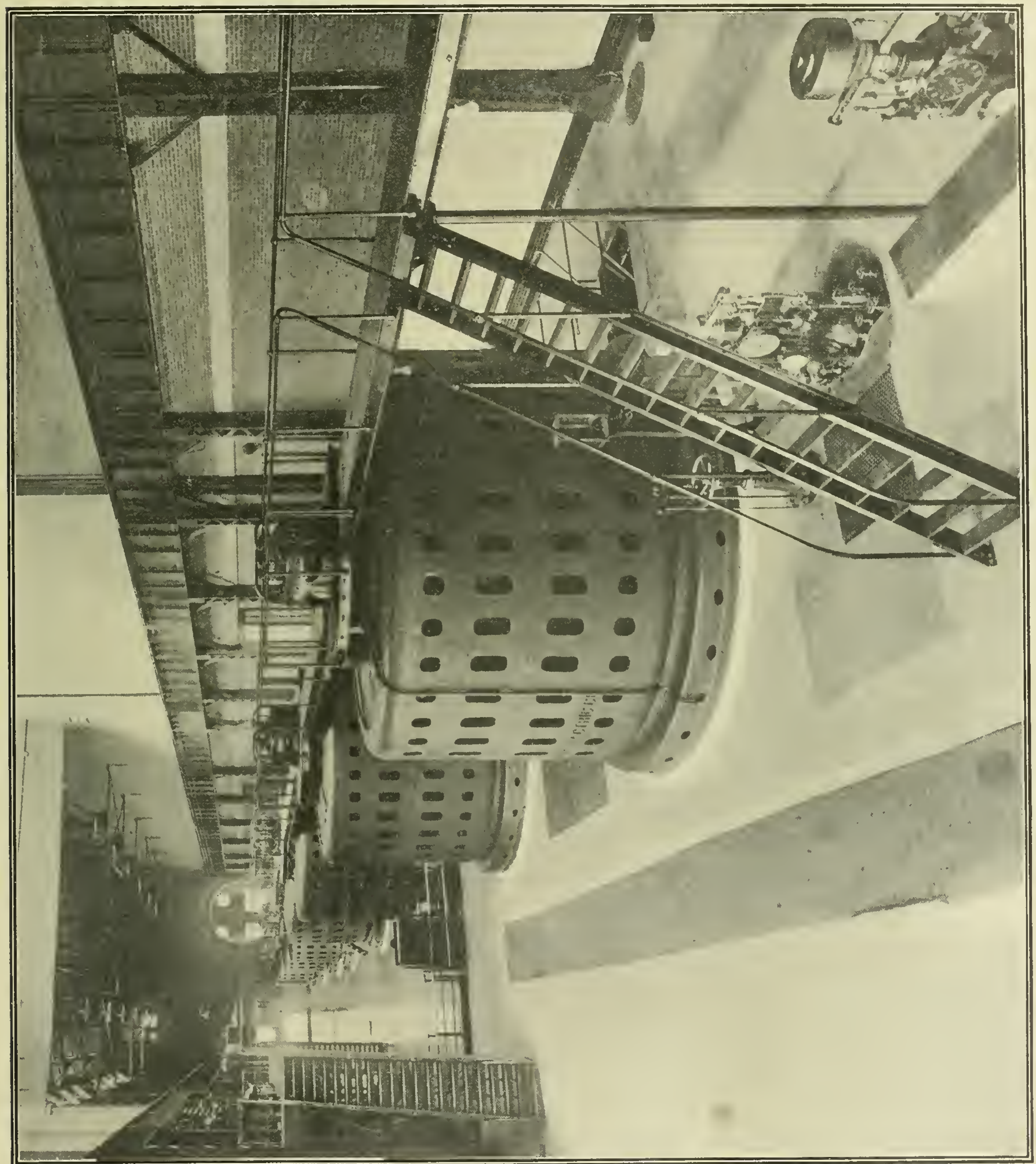
When, happily, the war is ended, and we count the cost, enormous though it be, in blood and treasure, we as a nation will have no vain regrets. We will have come through the sacrificial flames, and while in many homes there may be the vacant chair, while many purses may have shrunk to emptiness, the world will know that our young country, far removed from the scene of conflict and burdened with its own domestic problems, did not "Lag superfluous on the stage," but has set an example that will be remembered by generations to come.

Typical Canadian Hydro-Electric Developments



Units 11, 12, 13, 14 of the Ontario Power Co., Niagara Falls, Ont. These four generators are rated at 8,776 kv. a. normal, 12000 volts, 187½ r. p. m., 25 cycles. The Hydro-electric Power Commission of Ontario have a contract with this company for a supply of power up to 100,000 horse power.

Typical Canadian Hydro-Electric Developments



Toronto Power Company's Generating Station, Niagara Falls, Ont.—There are now eleven units as shown, 15,000 h.p. capacity each, operating under an approximate head of 130 feet.

Canada Must Have Many More Factories

There Are Many Things We Import that Might be Made at Home; and Many Things We Could Export if We Made Them.—TO-DAY the Time to Get Started

[The correspondence below is in response to a limited number of enquiries sent out to prominent central station men, electrical engineers and others directly or indirectly connected with the purchase, operation and maintenance of electrical equipment of various sorts, asking for suggestions which might assist our home manufacturers to widen, with advantage both to themselves and the consumer, the scope of their operations. This matter is referred to editorially elsewhere.—Editor.]

Fixation of Nitrogen

Editor, Electrical News:

The future of Canada lies in the development of its agriculture. Canada has been called the granary of the Empire. Our methods of farming are still primitive; the methods of cultivation used by the first settlers are yet the methods of today. The soil is rapidly being impoverished. Nitrogen in a form suitable for the enriching of the soil will soon be required and that in very large quantities. Plants must have nitrogen to live and the great majority of agricultural products, wheat particularly, obtain the nitrogen compounds necessary to their growth from the ground itself. Chilian nitrate of soda or Chili saltpetre is the best known of fertilizers and is exported from Chili and Peru to the different countries of the world in enormous quantities, over three million tons annually. The United States imported over 500,000 tons of the product in 1914; Canada's imports exceed 30,000 tons. Chili saltpetre is largely employed also in the manufacture of explosives, dyes and other articles.

Saltpetre can be **manufactured**; that is, the nitrogen of the air can be fixed. Oxides of nitrogen and nitric acid can be obtained by utilizing **electrical energy** to abstract the nitrogen in suitable form from the atmosphere. Large factories in Norway and Germany are producing atmospheric nitrates and are a commercial success. **Saltpetre manufactured in Canada for the British Empire is a new industrial enterprise which will surely have to be met as soon as our war is over.** We have the water power for developing the electrical energy, we have the atmosphere, we have the brains. Today is the time to think of getting this industry started.

Yours truly,
(Signed) L. A. Herdt,
Department of Electrical Engineering,
Montreal, Que. McGill University.

* * *

An Industrial Commission

Editor, Electrical News:

In many cases where the present depression has affected individuals and localities, the underlying trouble apparently is that the individual or locality is not a producer of the necessities of the country. For this reason, therefore, much personal energy is now either lying dormant or being expended without attaining financial results. If in the immediate future this energy can be concentrated toward the development of the requirements a great deal of good would be achieved.

Industrial history has repeatedly shown a **large financial waste from ill-advised investments in industrial enterprises,** the failure of which has in many cases been due to a limited market and the excessive expense of transportation. It would, therefore, appear that an **Industrial Commission organized of thoroughly competent and experienced men with powers to authorize the formation of industrials only after** careful investigation of the personnel of the company, the raw product which it is proposed to utilize and the facilities for manufacture and transportation, could produce most beneficial results in this country.

The status given to the enterprise by the endorsement of such an organization would increase the confidence of the public and lead to the development of enterprises which would prove successful within their own districts.

This Commission, further, through its studies would be able to advise the government what reasonable protection any individual line of manufacture should have in order to produce the article without being a burden to the consumers.

There is no question but that Canada owns many resources at the present time which are undeveloped and whose development would prove a great financial asset to the country, but it would appear that their development should be along systematic and rational lines.

Yours truly,
(Signed) A. K. Grimmer,
Medicine Hat, Alta. City Engineer.

* * *

Maintain Canadian Quality

Editor, Electrical News:

Your inquiry into the "Made in Canada" slogan is indeed timely. In the first place, we feel that we can compliment our Canadian electrical manufacturers on their wide-awake tendency to broaden their lines of output as opportunity offers. Most of them seem fully inclined to start a new line as soon as it becomes apparent that the demand is sufficient to warrant the expenditure on the necessary plant, and that such plant has a fair chance of remaining reasonably employed. It is obvious that the manufacturer cannot market an article for which the demand is fitful or intermittent, and do so at a price that will meet outside competition.

It is true that we are at present importing many specialties, particularly in the way of fittings for industrial and power house installation. The total annual value of all such articles combined must run into a considerable sum. The fluctuations, however, in the demand for any one line must be very considerable. Under such circumstances the Canadian manufacturers cannot be blamed for declining to take the gamble. The ultimate growth of our country will gradually solve these matters along natural lines.

We cannot close without touching on one other phase of the matter. Your query "Might not the over-use of this slogan tend to curtail competition to such an extent that the Canadian people would eventually have to pay much higher prices for their products?" is hitting dangerously close to the mark. Since the outbreak of the war there have been tendencies to shelter price increases behind a "Made in Canada" cry. We all admit the duty of the country to the manufacturer. Let not the manufacturer forget his duty to the country. Almost any man will show a preference for the Canadian product if offered about the same value at approximately the same price. Very few, however, care to have their patriotism enforced at the point of a highwayman's pistol. We do not infer that matters have reached that stage as yet. We sincerely hope that they will not. After

all, these matters must be handled in a give and take spirit—"Fifty-fifty" as the slang phrase goes.

Yours very truly,
(Signed) F. R. Ewart,
Toronto, Ont. Ewart & Jacob, Electrical Engineers.

* * *

Gears, Pinions and Wheels

Editor, Electrical News:

After considering the list of articles purchased by us from manufacturers who are not established in Canada, it would seem that **items such as steel cut gears and pinions** could be manufactured in Canada with a reasonable assurance of success.

Many electric railways are using **rolled steel wheels** at the present time. These are not purchased in Canada and it is questionable whether the total consumption in Canada would warrant the construction of a suitable plant.

From a commercial point of view the slogan of "Made in Canada" is, of course, of interest primarily to the manufacturer.

The purchaser is also interested as this procedure will result in upbuilding the country, thereby increasing his revenue. The interest on his part, however, will not usually extend to the purchase of inferior articles at prices higher than can be obtained elsewhere.

It is therefore **a matter of great importance that complete and efficient manufacturing plants be established so that the production of the highest grade of goods at prices which will compare favorably with foreign quotations** may be assured.

Yours very truly,
(Signed) G. Gordon Gale,
Hull, Que. General Manager, Hull Electric Co.

* * *

Need to Do Far More

Editor, Electrical News:

I certainly agree with you that **we need to do far more manufacturing in this country** than has been done in the past, but one of the first things to do is to offer the manufacturers ample facilities in the way of reasonable sites, low taxation, trackage, and reasonable assurance that the community in which he builds up his business will not tax him to the earth, as soon as he has reached an output that from his standpoint would be remunerative.

I have noticed so many times that towns try to make great capital out of the cheap power that they can offer to manufacturers, but in talking to prospective manufacturers, who have turned down apparently good propositions, where power is cheap, they have informed me that they would have had to pay **terrific prices for factory sites,** and **large taxes,** that more than offset cheap power. The instance cited above is one that I have heard repeated a good many times by men who have looked around with a view to putting up plants for the manufacture of various goods.

One business that I should like to see better established is the manufacture of woollen goods. On our wonderfully rich and fertile plains of the far West, are splendid opportunities for raising sheep, lots of room for factory sites, near the main arteries of the country, like the C. P. R., G. T. P., and C. N. R., and comparatively cheap power available. Most of our cloth is made either in Europe or the United States, and we are paying away far too much money for cloth which might just as well be manufactured in Canada from wool raised in Canada.

Throughout the West, the amount of canned vegetables consumed is enormous, and four-fifths of these same goods are manufactured outside of Canada.

Electrically, I do not think that there is much can be done, as there seems to be little apparatus imported from other countries other than within the Empire, which would likely yield sufficient returns to manufacturers here. Electrical business is reliant on prosperity in other lines of manufacturing, and as engineers, the best we can do is to boost as much as we can for factories in Canada for all classes of commodities, and when the demand for more electrical stuff is created by these manufacturers needing electrical apparatus, I believe that more and more the electrical manufacturer will get the business entirely into his own hands. Even at the present time, as you know, the three largest electrical companies in this country, though in a good many instances their designs, particularly in new apparatus, are made up in the United States, the manufacturing of them is, however, taken care of in their Canadian factories.

Yours very truly,
(Signed) Charles F. Gray,
Winnipeg, Man. Consulting Electrical Engineer.

* * *

Clay Duct, Cooking Devices

Editor, Electrical News:—

In reply to your letter regarding the further development of trade in the British Empire, I think that as far as the making of things in Canada is concerned, very distinct progress has been made during the past few years, and increased development along this line would seem desirable, if it can be secured without an undue amount of protection, which increases the cost to the consumer.

I do not think that **clay duct for underground cable** systems is manufactured in Canada. There is an increasing demand for it, and freight represents a considerable part of its cost. Why should it not be made by some of the sewer pipe factories in Ontario and Quebec?

The low rates prevailing now for electric power in Ontario greatly encourage the use of **electric cooking ranges and many of the smaller current consuming devices.** This prospective good market should permit of the manufacture of such devices in large enough quantities to reduce prices materially, which will result in still further stimulation of their use.

Why should it be necessary for us to import manufactured articles in the following extent annually:

Belting	$ 530,000
Common window glass	1,110,000
Wool and manufactures thereof	24,400,000

These are just a few items taken at random, a portion of which could, no doubt, be "Made in Canada" to our advantage.

Yours very truly,
Signed, A. L. Mudge,
Toronto, Ont. Consulting Electrical Engineer.

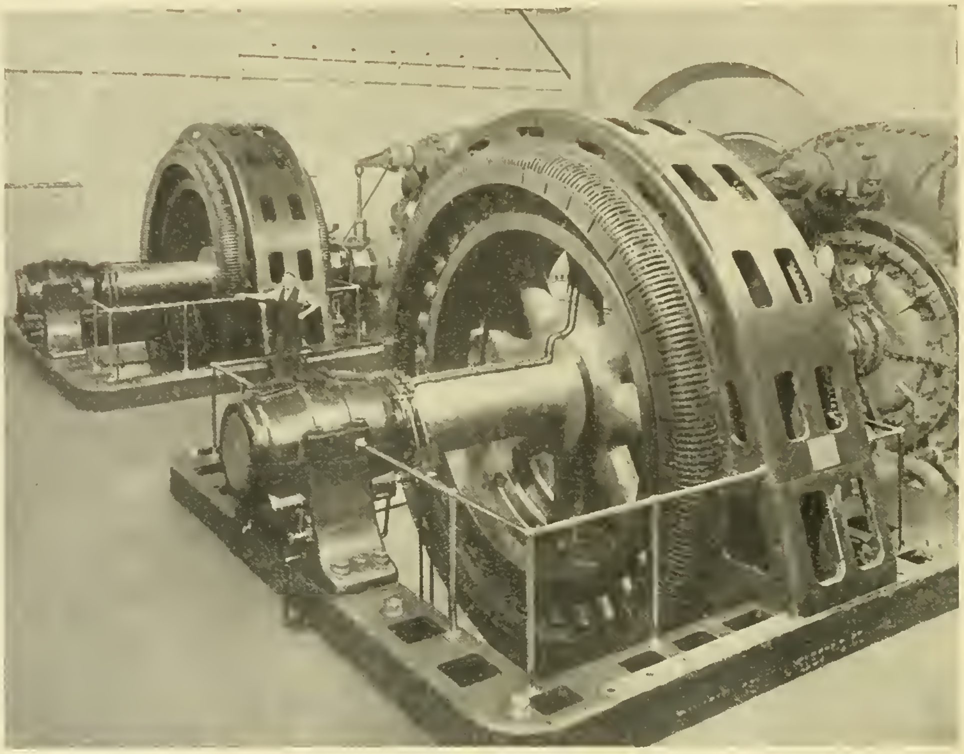
* * *

Widen Our Market

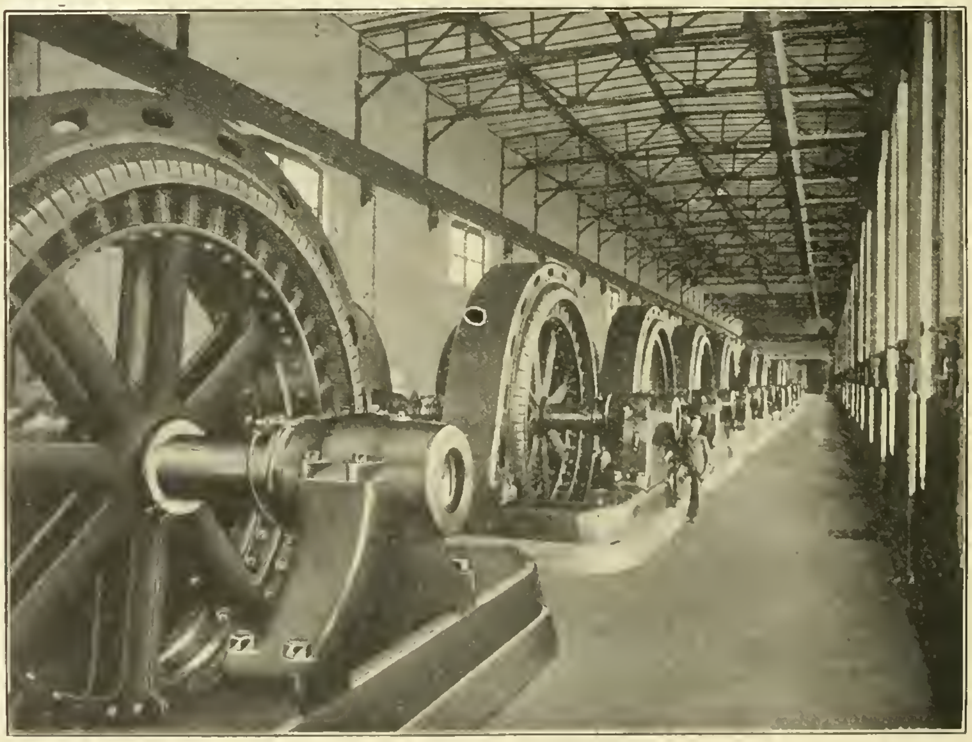
Editor, Electrical News:

Replying to your request for information as to what material we purchase outside of Canada which we consider could with advantage be made in Canada. This matter has been one which has always been of considerable interest to myself. Wherever possible I have been in the habit of giving preference to Canadian-made goods, other things being equal. There are, however, **many articles purchased by us which we think could be made in Canada to advantage,** although at the present time they are not made at all, or are only made in such a small amount that it is impossible to get anything like competition in bids, or even satisfactory articles, if one were to insist on only Canadian-made goods being supplied.

It would appear to me that some of the larger manu-



Two 13,000 h.p. units of the Western Canada Power Company. The nucleus of a 100,000 h.p. development on the Stave River, B. C.



Plant of Winnipeg Electric Railway Company on Winnipeg River, Manitoba. A second and larger plant is under consideration at the present moment.

Typical Undeveloped Canadian Water-Powers

Grand Rapid, Athabaska River, Alberta.

"The Notch", Montreal River, Northern Ontario.

facturers in this country are very much to blame for this state of affairs. In many cases, when establishing works in Canada, they only make a small portion of their goods for sale in this country, importing the other material from the United States, or abroad. In many cases, these firms, when submitting this material, endeavor to work on one's preference for Canadian-made goods, even putting up arguments in favor of goods made by their American branches against goods made in Great Britain. This refers particularly to such articles as street lighting equipment, cables, potheads and accessories, electrical instruments, turbo generators, lamps, etc.

It would appear that the above articles imported from the United States could with advantage be made in the Canadian works of the various companies, although in certain special cases, it may be argued that the demand for these articles does not warrant manufacturing in this country. This could hardly be so in most cases, particularly in regard to street lighting equipment and incandescent lamps.

Again, in many of the other cases, goods are imported from the United States owing to the limited demand for them here. If the Canadian works were to do this manufacturing and inaugurate a well-thought-out selling scheme, there is no doubt that the market for these goods could be considerably increased.

It seems to me that if the "Made in Canada" slogan is to have the desired effect, it will be necessary for local firms to give a good deal of thought as to which articles are the most satisfactory and could be made without any undue expense in this country.

It has to be borne in mind that Canada at the present time, and for some years to come, will depend upon other nations for capital to develop her resources. To obtain this capital, there must be trade with the countries which will lend her the money, so that were we to build everything we require, it is doubtful if the country as a whole would benefit, owing to the natural reluctance which would be shown by other countries to advance the money where there was no return in increased trade and also to the liability of having to pay more than the article is really worth, due to local conditions making manufacturing costs excessive.

Yours truly,
(Signed) J. G. Glassco,
Winnipeg, Man. Manager, Light & Power Dept.

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Electric Smelting and Refining

Editor, Electrical News:

I do not care to pose as an authority on a subject as broad as the one suggested by you, but in a general way I would suggest that there was room in Canada for several electro-magnetic processes such as the smelting of nickel, iron, copper, etc., most of which work at present is done outside the country. I also believe that the use of cobalt could be extended to a degree that would utilize the product of our Northern Ontario district to a much larger percentage than at present. Among other processes requiring electricity in large blocks the manufacture of cyanamid for fertilizing purposes, etc., should be a business warranted by our large investment in agriculture particularly adaptable to Canada and would render valuable our many natural water powers at present undeveloped or only partially in use.

It would appear from the present war conditions that opportunity arises to commence the manufacture of small arms not only for our own use but to re-arm a large proportion of the armed forces of Europe, and I am informed that the American nation is already establishing new small arm factories with the idea of obtaining contracts to replace the tremendous wasteage going on at present. This is merely a thought, and as large fortunes have been made in the past from the supply of armaments of various kinds, we, with our natural resources of nickel, iron, copper, etc., should be in an unexcelled position to produce the finished article more cheaply than a nation requiring to import raw materials.

We at present are obliged to import manganese bronze and other special metals and also underground conduit duct, which is becoming more necessary to plants located in cities, but as far as I know there are no plants in Canada adequate to supply the demand.

I have had no time to make a study of the matter, and no doubt others better qualified to give you the information required can extend this list to a considerable length, and if capital is available many legitimate industries can be made self-sustaining if the consumer can be persuaded that the native-made article will stand up to the rigid requirements of our present-day practice in many lines.

Yours very truly,
(Signed) D. H. McDougall,
Assistant to the Manager,
Toronto, Ont. Toronto Electric Light Company.

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What of the Trade Commissioners?

Editor, Electrical News:

I have yours of the 11th inst., regarding the question of the further development of trade within the British Empire. This is a somewhat difficult question to answer without looking pretty closely into the whole thing, but there are one or two things which occurred to me which might be mentioned.

One of these is the use, or rather the non-use, of the facilities provided by the Government for the furthering of trade with other countries. The Government has Consuls and Trade Commissioners appointed for this purpose, and I doubt if they are very busy over Canadian trade matters.

Another thing which I think has a great effect upon the volume of trade coming into Canada from the United States is the fact that Canadian manufacturers quote prices which are practically the same as American prices plus duty and freight. There may be reasons which I, not being a manufacturer, am not aware of, for the higher price of Canadian-made goods, but it seems to me that the persistence with which Canadians hold their prices up to the level of the American prices, plus freight and duty, for what is frequently an inferior article, is one of the greatest reasons tending to keep down the volume of Canadian trade.

Consumers wish to be patriotic, but when they are offered inferior articles at the same price as imported articles of better quality, will generally purchase the imported article.

Owing to the somewhat smaller market and possibly the higher cost of labor, and in some instances, duty on raw material, the Canadian manufacturer is at a disadvantage. Possibly the Canadian manufacturer wants too great a percentage of profit and is thereby biting his nose to spite his face.

Yours very truly,
(Signed) W. K. Greenwood,
Orillia, Ont. Engineer.

* * *

We Have the Raw Material

Editor, Electrical News:

Replying to your letter of February 1st, I may say that in order to encourage the further development of trade within the British Empire, and especially to carry on the campaign to encourage people to use goods "Made in Canada," I consider a systematic effort should be made to find out what articles of manufacture have been imported into this country from the countries now at war in Europe, also what articles of manufacture these countries exported to other parts of the world; if this were done and an effort then made to have plants established in Canada to manufacture these

goods there is no doubt our country at large would benefit to a great extent. We have the raw material necessary to make hundreds of different articles which have been made in Europe and then sent over here, and if the matter is gone into in the proper way the results will be satisfactory, but in my opinion it is something one cannot go at in a haphazard sort of way, it must be done carefully and scientifically, so that we will find out what articles are purchased in the largest quantities, and what can be made in Canada at the greatest profit to the manufacturer. This is a question that can very well be taken up by some of the large power companies who are looking for a market for their surplus electrical energy, and if one of the larger companies or group of companies took it up I am sure they would get a large return for the money spent. It is difficult to say just what lines should be gone into, and I would like to see the matter investigated by a committee or a commission of some sort.

Yours truly,

(Signed) J. H. Larmonth,

Edmonton, Alta. Supt., Edmonton Radial Railway.

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Manufacturer Must Play Fair

Editor, Electrical News:

What should be done to increase our capacity as manufacturers? Anyone deriving a certain benefit from something has also to accept ipso facto a certain amount of obligation and responsibility; it cannot be helped. Our manufacturers are reaping more or less large benefit from protection against foreign competition by a high tariff, which in some cases goes as high as 33 per cent. Why cannot they offer us their goods at a little lower price than the American goods? **We go on the American market, we buy goods at prices for their home consumption,** (not at dumping prices, as our Canadian Customs are looking after that), **we pay from 20 to 30 per cent. duties, besides higher freight or express charges, and on figuring our cost price we find that we have paid about the same price, sometimes a little less, than we would have paid for the Canadian goods.** Must we conclude that the Canadian manufacturer has to make from 20 to 30 per cent. profit more than the American manufacturer on the same kind of goods, or is it because the Canadian manufacturer cannot manufacture at the same production cost? Wages are cheaper in Canada, power in many places is cheaper. In this city, for instance, the highest power charge is $16.80 per h.p. year. Shipping facilities are good. Presumably one drawback for the Canadian manufacturer is that he cannot manufacture in as large quantities as in the United States on account of the market and the demand being much smaller.

Canada's purchases in the United States in one year are amounting to three times the total amount of our sales to the same country. I understand that we are their third best customer. Why? And this with very high custom duties. Is it because the American goods are of a better quality? Is it because we need a lot of goods that they manufacture and that we do not? Is it because we are buying from them a lot of half-finished goods to be finished in this country? Is it simply for the sake of giving revenue to our Government? Those are so many questions I would like to have explained to me.

It is a good move to induce consumers to buy Canadian-made goods, through a boosting campaign like the one that is made through the newspapers at the present time. But this is not sufficient. The manufacturer must also do his share. The consumer has his eyes open specially in our eastern townships; he knows through his knowledge of the market of the United States, that his first cousin, the American consumer, is getting a better home market price in manufactured goods of luxuries or necessities to life than he is getting on his own home market. He wonders why.

Our protective tariff and our market have induced a lot of foreign manufacturers to establish factories in this country. It has been a good thing for our country; the laboring classes have earned a good deal of wages that used to be earned in a foreign country; a lot of manufacturing companies were formed, we should call them only the Canadian daughter company of the foreign mother company in the United States or elsewhere. Before the beginning of the war they advertised their "Canadian-made goods" right and left, and since the beginning of the war they should have called their goods "Canadian assembled goods," instead of "Canadian-made goods," especially in the electrical business. As soon as the war broke out we were notified by the majority of them that on account of the difficulty in procuring raw materials, the old prices were cancelled and new quotations would have to be asked for.

We have copper, brass, iron, steel, aluminium, glass, asbestos, nickel, insulating materials, etc., in this country. We are reputed to be the greatest mining country perhaps in the world. Induce our manufacturers to manufacture from raw materials as much as possible. This would increase the size and number of our factories; the laboring classes will benefit by it and our commerce will be much enlarged. We have immense water powers, large supplies of electric energy, fairly cheap labor, good mechanics, and in fact, everything to guarantee fairly cheap production cost. If the manufacturers make goods of good quality, not only in appearance, but equal to any foreign goods, they will capture the bulk of our market which is presently going to the United States for its supply, and they will also compete with foreign manufacturers on the markets of the world which are now open and will be open to them for many years to come.

Yours truly,

(Signed) B. A. Dugal,

Accountant,

Sherbrooke, Que. Departement du Gaz et d'Electricite.

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Nitrates From Atmosphere

Editor, Electrical News:

In reply to your letter of the 11th inst., I could suggest **many chemical processes** which might be carried on in Canada. For example, **the manufacture of nitrates from atmospheric nitrogen by the use of electricity** generated by the use of water power. As to how far the demands in Canada for such products would justify the erection of the requisite plant, I am not in a position to advise.

Yours very truly,

(Signed) W. H. Ellis,

Acting Dean, Dept. of Applied Science.

Toronto, Ont. University of Toronto.

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Should Not Export Raw Material

Editor, Electrical News:

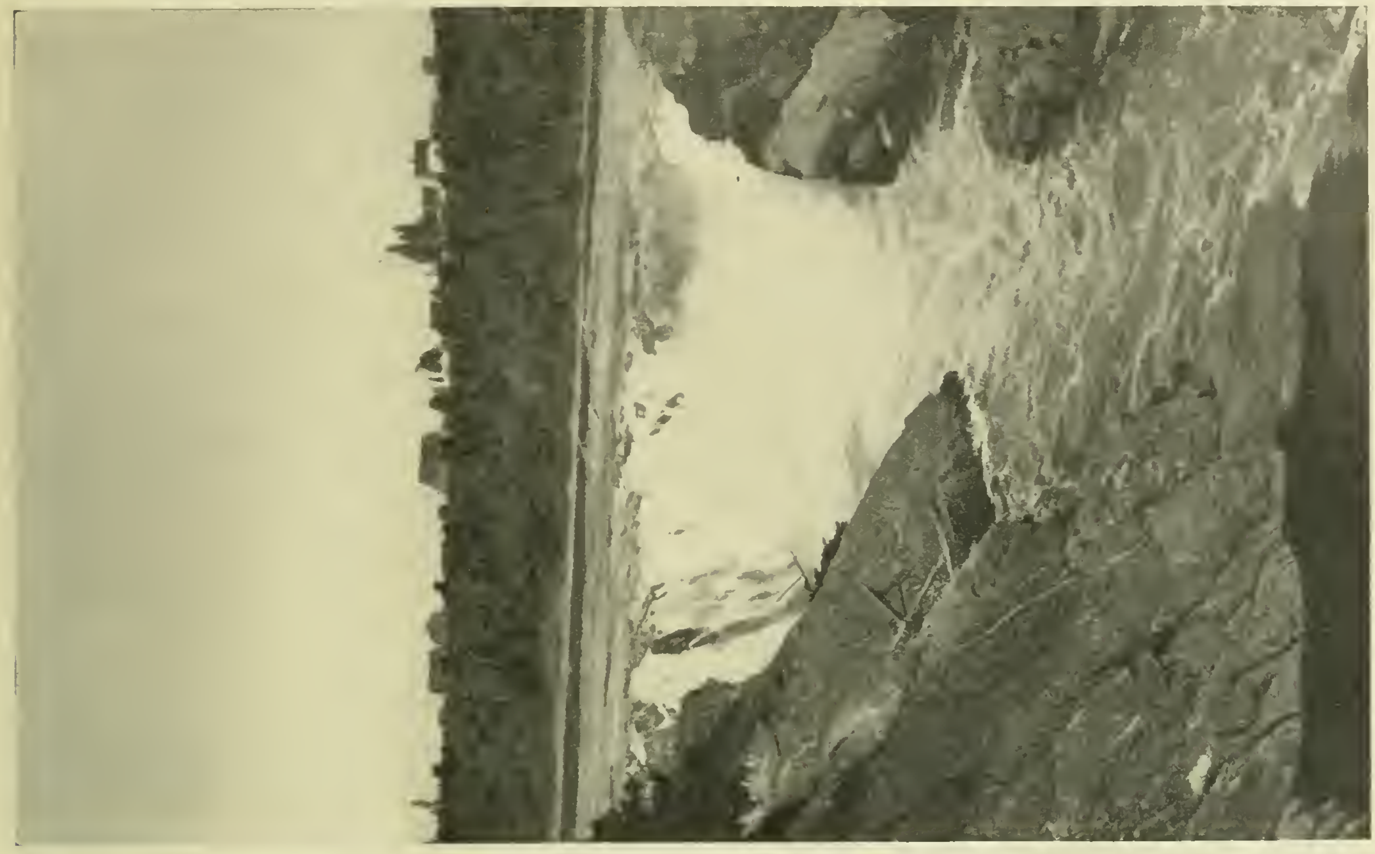
I might suggest many things which could be manufactured advantageously in Canada, such as electric meters, small electrically-driven refrigerating plants for private use, and a great many of the electrical fittings which it is now found necessary to import. But there is one thing which has been a very large factor in the marvellous commercial success of the country to the south of us, and that is, **the development of manufacturing direct from the raw material. This is particularly true with regard to iron and copper.** This is, of course, largely due to the immense available supply of coal, but **we have in this country a practically unlimited supply of water power** in the northern part of the Pro-

Typical Undeveloped Canadian Water-Powers

Metis Fall, Metis River, Metane, Quebec.

Ouiatchuan Falls, Lake St. John, Quebec.

Typical Undeveloped Canadian Water-Powers



Grand Falls, St. John River, N.B.

Little Qualicum Falls, Vancouver Island, B.C.

vince of Ontario, within reasonable distance from vast mountains of iron ore, and unlimited deposits of copper.

At the present time I understand that practically all of our copper has to be shipped to the United States to be smelted, and that the only copper rolling mills within reasonable distance of Toronto has to import all raw material from the United States. If these minerals were treated electrically at the mines, and an unlimited supply of cheap material thus supplied, the manufacture here of all lines which it is now necessary to import would follow as a natural sequence.

This is too large a subject to do more than mention at this time, but the results of such a development would no doubt be most far-reaching.

Yours truly,
(Signed) Thomas Henry,
Chief Engineer, Interurban Electric Company, Ltd.
Toronto, Ont.

* * *

Utilize By-Products

Editor, Electrical News:

In reply to your letter of the 1st. instant, would say that it is possible to work the "Made in Canada" slogan to such an extent that it would end in a decided disadvantage to the Canadian people.

In promoting new enterprises and developing our present industries, we must first consider our natural resources, then promote and develop industries in which these resources can be utilized to their full extent.

Our water powers, timber, minerals and land are exceptionally good. Are there not opportunities of developing these further? What about the by-products of the raw materials? What about the various industries that require power in large quantities?

With raw materials and cheap power, it appears to me that these items would be sufficient to offset the cheap labor in Europe, and enable us to keep the raw materials in Canada and turn them out into manufactured goods.

In this section of the country, where 90 per cent. of the world's asbestos is mined, there appears to be an opportunity for manufacturing instead of shipping the raw material out of the country.

Yours truly,
(Signed) N. C. Pilcher,
General Manager,
Sherbrooke, Que. Sherbrooke Railway & Power Co.

* * *

Protect by Higher Tariffs

Editor, Electrical News:

Replying to your favor of the 1st. instant, I do not think that a consulting engineer, the least myself, would be competent to express a view on the matter. Undoubtedly many articles are being imported that might be manufactured in this country. Whether such articles could be manufactured at a profit, taking into consideration the comparatively small population of this country and consequently limited demand, especially in view of big competition, is a question that can only be answered by the manufacturers themselves. I have no doubt they are manufacturing everything where they can see a reasonable profit. To increase the "Made in Canada" goods, there can be only one solution—permanent increased tariffs; where necessary a wall of tariffs so high that even the United States cannot climb over same. Such a wall of tariffs would, in my opinion, be the only justification to increase and develop the manufacturing plants in the Dominion of Canada. I do not think such increased tariffs would increase the cost to the people. Increased factories mean increased competition and would prevent large profits to the manufacturers. On the other hand, it would mean prosperity even for the poor man, and therefore benefit the whole country.

Yours very truly,
(Signed) Charles Brandeis,
Montreal, Que. Civil and Electrical Engineer.

* * *

Large Capacity Hydraulic Machinery

Editor, Electrical News:

Replying to yours of 1st inst. Judging from Canadian imports and past development of our resources, there should be a good field for the Canadian manufacture of high-class, high efficiency, large capacity water wheels, governors, gates, and other hydraulic equipment, to replace importation from outside firms of established reputation.

This is but one line of endeavor. There must be many such, which a close study and analysis of our country's imports, and other countries' exports and methods, would quickly reveal.

The Canadian Manufacturers' Association, if not already doing so, should, through its organization, and by means of co-operation with the various governments, Boards of Trade, etc., throughout the country, and its individual members, concentrate their endeavors on all forms of Canadian industrial development. To compete in the markets of the world, organization, co-operation, efficiency, and service, must be developed to their highest extent.

Yours very truly,
(Signed) W. L. Bird,
Manager and Secretary,
Fort William, Ont. Kaministiquia Power Co., Ltd.

* * *

Can Manufacture Anything

Editor, Electrical News:

My experience is that practically everything needed by the people in Canada can be purchased in Canada from Canadian manufacturers. Canada, with her natural resources and skilled workmen, can manufacture anything, and if the people living in the country would make up their minds to use only the home-made goods everyone would benefit. The importer can sell his goods because he can undersell the Canadian, but if it is correct that the Canadians can manufacture flour, machinery, etc., and sell it in Europe, as I believe, cheaper than they do in Canada, he should be able to sell all of his goods to compete with imported goods.

Yours truly,
(Signed) E. J. Tett,
Lacombe, Alta. Town Electrician.

* * *

Why Not Export the Surplus?

Editor, Electrical News:

In answer to your letter concerning further development of trade in Canada, I find it rather difficult to ascertain what lines in their entirety are manufactured in Canada.

There are many articles, which we are given to understand are of Canadian manufacture, that are imported in parts and only assembled or partly manufactured here. Undoubtedly there are several lines for which there is a good demand in this country that could be manufactured at home and sold at the same or possibly at a lower price than what we are obliged to pay at present by importing. At the same time there are other lines for which the demands are so small or intermittent that the manufacturer would be compelled to have side lines in order to keep a working staff together; consequently, he is unable to specialize on any particular article, and either manufacture goods of an inferior quality or at a considerable advance in price over the imported article.

Yours truly,
(Signed) C. North,
Revelstoke, B.C. Supt. Electrical Department.

World Commerce in Electrical Goods

Germany's Total Exports of Electrical Goods in a Recent Year Amounted to Over Eight Million Pounds Sterling—Austria's Less Than 5% of That Amount—Thanks to Britain's Fleet These Markets Are Now Open to the Rest of the World—A Rare Chance to Establish New Business Connections

At the same time that Germany has forced us into unwilling participation in a war in which our national unpreparedness can only be compared in extent with the systematic perfection of the enemy's plans, this conflict has also brought home to us the true situation with regard to the industrial aggressiveness of the German nation and the perhaps too conservative attitude of British manufacturers regarding the question of enlarged markets, competitive salesmanship, and the production of an article designed to meet the wishes of the customer rather than the traditional specifications of the manufacturer.

German industrial activity during the past few years has been at once the admiration and surprise of competing nations, admiration because this aggressive policy has been the means of placing the German nation in the front rank of manufacturing and exporting countries of the world, and surprise that the competitive prices this nation has quoted have not landed her long ago in the bankruptcy courts. The low prices have been explained away in part by the comparatively very low rate of wages paid to labor in Germany—the result of the state of semi-feudalism in which the German laborer and his family are still held—but it has become increasingly apparent that an important reason lay also in the ultra-liberal attitude of the home government and home banking interests towards their manufacturing industries in the matter of financial assistance. It is now said that as a result of the close price cutting adopted by this nation's manufacturing concerns, many industrials found themselves in the early part of the summer of 1914 on the verge of bankruptcy, which, on account of their relationship, threatened to involve the government and the banking system generally of that country. It has even been said that the situation had become so acute that this constituted one of the prime reasons why Germany decided to strike, in the hope of adding to her national wealth by the acquisition of new territory, and, incidentally, at the same time, crippling the competitive powers of her commercial rivals.

Be that as it may, the other governments of the world have had the reality of German competition brought home to them in a most forcible manner by the present war. Statistics are being eagerly studied, trade openings sought out, conditions and possibilities reported upon at various points, chiefly of the southern hemisphere, and this, coupled with the fact that German and Austrian manufacturing and commerce will inevitably be crippled more and more as the war proceeds, would seem to insure a thorough reorganization and readjustment of the world's trade and commerce within the next two or three years.

As a result of these investigations the other manufacturing nations of the world are now more or less actively engaged in extending their business connections and caring for the needs of former German and Austrian customers both at home and abroad. This is equally satisfactory from the viewpoint of the belligerents as of neutral nations, because nothing is likely to bring Germany to her senses so quickly as the recognition of the impending destruction of her commerce, just as her hankering for commercial supremacy was apparently the chief reason why she has forced this war upon so many nations of the earth. In this commercial warfare England is, without question, taking a pre-eminent part, and there is no reason why Canada should not lend her assistance and profit by the conditions under which we find ourselves, though unwillingly, placed. In the first place Canada has been an importing country to a much greater extent than appears to have been necessary. In the second place, we should be able to manufacture many of the requirements of other nations less favorably situated than ourselves in the way of manufacturing possibilities, and so should be able to increase our exports of manufactured products very greatly under the new conditions.

This is no less true in electrical matters than in other lines of commerce. Though Canadian electrical factories of considerable magnitude have been established we are still large importers of electrical equipment of various sorts. The argument has been advanced, doubtless with force, that our limited demands would not justify the establishment of factories. This is true only in so far as the output of these factories would be limited to the Canadian market, but whereas at the present time, the markets of the world are open to Canadian manufactured products (as they are to other manufacturing countries) we do not see that this argument against the establishment of numerous Canadian factories for making products which are required the world over holds with any particular force.

The London, England, Board of Trade has prepared some very interesting and valuable statistics regarding the electrical situation as it stood with reference to imports in the chief electrical consuming countries of the world a short time previous to the outbreak of the war. This has been issued in the form of memoranda and more or less widely distributed, but we believe that its importance justifies a reiteration of many of the figures in our present issue. It is very evident that Germany, and much more so than Austria, has been most successful in placing her products in competition with Great Britain and the United States. While this may have been a matter of concern before the war broke out, it should now, thanks to the unchallenged supremacy of the British Navy, be a source of satisfaction that such fields are thrown open to the manufactured products of Great Britain and her colonies, as well as, of course, the other nations which may be in a position to reach these markets.

Quoting from the memoranda prepared by the London Board of Trade we find that the value of electrical apparatus and appliances exported from Germany and Austria-Hungary to all other countries for the last year for which such figures are available are as follows—(Table I.).

Dynamos, Motors, Converters, Etc.

In the matter of dynamos, motors, converters, transformers, etc., we find that the total exportation from Germany during a recent year was, to all countries, slightly in excess of that from the United Kingdom. The value of Germany's total exports in 1912 amounted to £2,521,000; Austria-Hungary in 1913 exported similar equipment to the value of only £62,000; the United Kingdom in 1913 exported to the value of £2,269,000.

The principal markets for German dynamos, motors, etc., are Argentina, Russia, Italy, Japan, Spain, the Netherlands, Brazil, and the United Kingdom—the bulk of the trade being in the heavier kinds of machinery. This is shown by the following table (Table II.), which gives the value of the

Table I.

TOTAL EXPORTS FROM GERMANY AND AUSTRIA

	Exported from Germany (1912)	Exported from Austria-Hungary (1913)
	£	£
Dynamos, electro-motors, converters, transformers, etc.	2,521,000	62,000
Ready worked armatures, commutators, etc.	382,000	......
Storage batteries, spare plates for same (electrodes):		
With celluloid, vulcanite, etc.	38,000	320
Without celluloid, vulcanite, etc.	319,000	
Electric arc lamps, mercury vapor lamps, etc.	133,000	16,900
Complete frames for arc lamps, mercury vapor lamps, etc., with glass globes (also covered with network)	28,000	
Searchlights—light diffusing reflectors	54,000	......
Metallic filament and metal wire lamps	2,307,000	223,000
Carbon filament, Nernst, etc., electrical incandescent lamps	170,000	
Electrical appliances for illumination, transmission of power, etc.; series resistances and shunt resistances, etc., and parts thereof	2,082,000	85,500
Total of the foregoing	8,034,000	387,720

German exports of the goods mentioned above, that is, dynamos, etc., to sixteen of her principal markets in 1912. This table also shows the preponderance of the value of the heavier equipment. The goods shipped to these sixteen markets represent approximately 75 per cent. of the total exports from Germany of such goods.

Table II.

GERMANY'S PRINCIPAL MARKETS

	Up to 100 Kilogs.	Over 100 Kilogs. and up to 500 Kilogs.	Over 500 Kilogs	Total
	£	£	£	£
United Kingdom	37,000	45,000	46,000	128,000
British South Africa	.....	5,000	80,000	85,000
Australia	5,000	16,000	5,000	26,000
France	31,000	29,000	57,000	117,000
Italy	31,000	42,000	148,000	221,000
Norway	7,000	15,000	66,000	88,000
Roumania	.....	9,000	46,000	55,000
Russia	52,000	66,000	112,000	230,000
Spain	21,000	35,000	105,000	161,000
Netherlands	25,000	42,000	67,000	134,000
Japan	8,000	13,000	151,000	172,000
Argentina	10,000	28,000	199,000	237,000
Brazil	13,000	44,000	69,000	126,000
Chile	2,000	20,000	36,000	58,000
Mexico	3,000	7,000	20,000	30,000
Uruguay	4,000	5,000	15,000	24,000

Austria-made goods of the same class have been principally marketed in Italy, Roumania, Bulgaria, Turkey and Greece, as is shown by Table III., which gives the value of the exports of these goods in 1913 from Austria-Hungary to her principal markets. The figures given in the above table represent approximately sixty per cent. of Austria's total exports of such goods

Table III.

AUSTRIA'S PRINCIPAL MARKETS

	Dynamos, Electro-Motors, Transformers, &c., weighing— 500 Kilogs. and under.	Over 500 Kilogs. and under 3,000 Kilogs.	Over 3,000 Kilogs.	Total.
	£	£	£	£
To United Kingdom	....	200	....	200
To Italy	7,700	4,000	500	12,200
To Roumania	4,100	600	1,200	5,900
To Russia-in-Europe	1,500	1,900	....	3,400
To Turkey-in-Europe	1,700	700	2,300	4,700
To Bulgaria	600	800	4,600	6,000
To Greece	550	1,600	1,200	3,350

Britain's principal markets are shown in Table IV. It will be seen that Australia is her best customer, followed in order by Argentina, Japan, British South Africa and France. In all of these countries there is competition with German and Austrian products and to such an extent that while the aggregate value of the British exports amounted to £1,336,100 in 1913, the combined German and Austrian exports total £2,583,000. In the countries given in Table IV., therefore, there would seem to be ample scope for the further development of British, including Canadian, trade in the heavier types of electrical machinery.

Table IV.

GREAT BRITAIN'S PRINCIPAL MARKETS

	£		£
British South Africa	144,900	Greece	1,300
Australia	285,400	Roumania	1,300
Russia — Northern ports	51,400	Bulgaria	......
Southern ports	8,500	Turkey, European	3,300
		Japan	187,900
		Argentine	213,500
Norway	26,800	Brazil	101,600
Netherlands	10,000	Chile	54,800
France	114,600	Uruguay	14,700
Spain	60,300	Mexico	10,000
Italy	45,800		

Lamps

In the manufacture of lamps of the incandescent type Germany exported metallic filament lamps to the value of £2,307,000, and carbon filament and other types to the value of £170,000, making a total of £2,477,000. During a similar period, the year 1913, the total value of Austria-Hungary exports of similar lamps amounted to £223,000, and during the same period the exports of the United Kingdom only reached the value of £152,500—comparatively speaking, a negligible quantity.

The principal markets of German lamps are the United Kingdom, France, Italy, Russia, Spain, Argentina, Brazil, and other South American countries, China and Japan. This is shown in the following statement (Table V.). It represents a total of over 75 per cent. of Germany's exports of these goods.

The principal markets for Austrian-made lamps in 1913 were Italy, Russia, United Kingdom, Roumania, United States and Norway. Italy took Austrian goods to the value of £52,000, Russia £47,000, Britain £29,400, Roumania £6,-200, United States £5,700, Norway £5,000.

The market for British manufactured glow lamps was chiefly India, British South Africa, Australia, Argentina, Canada. British India took lamps to the value of £27,700, British South Africa to the value of £27,400, Canada to the

Table V.

PRINCIPAL MARKETS FOR GERMAN LAMPS

	Metallic filament Lamps	Carbon filament Nernst, and other electric incandescent Lamps.	Total
	£	£	£
United Kingdom	294,000	24,000	318,000
South Africa	27,000	1,500	28,500
Canada	27,000	5,000	32,000
Australia	18,000	2,000	20,000
Denmark	51,000	4,000	55,000
France	119,000	9,000	128,000
Italy	174,000	20,000	194,000
Norway	55,000	3,000	58,000
Russia	435,000	31,000	466,000
Finland	28,000	1,000	29,000
Sweden	75,000	2,000	77,000
Spain	139,000	3,000	142,000
United States	38,000	6,000	44,000
Argentine	74,000	7,000	81,000
Brazil	84,000	8,000	92,000
Chile	38,000	1,000	39,000
China	38,000	3,000	41,000
Japan	40,000	500	40,500
Mexico	30,000	2,000	32,000
Total £	1,784,000	133,000	1,917,000

value of £8,100, Australia £40,200, Argentina £14,300, China £7,100, Brazil £4,800.

The value of electrical appliances for illumination, power transmission and electrolysis; series resistances, shunt resistances, etc., exported by Germany to all destinations in 1912 amounted to £2,082,000. A list of the principal markets to which these goods were consigned are given in Table VI., the countries specified there representing approximately two-thirds of Germany's total exports of such goods. From Austria the exports to all points in 1913 of electrical apparatus and electro-technical appliances (regulators, resistances, starters, and so on), not specially classified elsewhere, amount to £77,000. The principal markets were: Turkey £15,400, Russia £8,300, Bulgaria £5,200, Italy £3,800, Roumania £3,700, France £3,600.

Table VI.

GERMAN EXPORTS OF ELECTRICAL APPLIANCES FOR ILLUMINATION, POWER, TRANSMISSION, ELECTROLYSIS, ETC.

	£		£
To United Kingdom	137,000	To Russia	272,000
To British South Africa	41,000	To Sweden	72,000
To Denmark	51,000	To Spain	83,000
To France	95,000	To Argentine	153,000
To Italy	171,000	To Brazil	77,000
To Netherlands	82,000	To Chile	34,000
To Norway	74,000	To Uruguay	23,000
		To Japan	59,000

Table VII.

BRITISH EXPORTS OF UNENUMERATED GOODS

	£		£
British South Africa	86,700	Bulgaria	......
Australia	140,000	Russia—South	6,500
Norway	7,600	Turkey—European	3,500
Denmark	7,100	Turkey—Asiatic	900
Netherlands	15,200	Egypt	13,300
France	58,000	Mexico	900
Spain	27,400	Brazil	80,400
Italy	23,000	Uruguay	6,400
Greece	2,800	Argentina	72,100
Roumania	8,700	Chile	47,000

Details of the exports of British-made electrical appliances of the kinds referred to above are not available in the trade returns of the United Kingdom, but the following particulars of British exports of "unenumerated electrical goods and apparatus" to the markets mentioned will be of interest. The countries mentioned in Table VII. account for a total of £607,500 of British goods, as compared with the aggregate value of German and Austrian exports of the special kinds referred to (more or less similar), to the amount of £1,482,700. The trade memoranda state that, as the British figures probably cover a larger number of articles than the detailed figures for Germany and Austria, this would indicate that the possible opening for British trade in these classes of goods is somewhat better than is indicated by the actual figures given.

The memoranda issued by the London Board of Trade also include valuable figures on the imports of various electrical materials into a number of British colonies, as well as other large importing countries. These will be noted briefly.

South Africa

The total imports of various electrical materials into South Africa in 1913 is given in Table VIII. The report from which we quote states that German electrical firms have been particularly active in South Africa during the last few years. The electrification of the Rand has led to large importations of electrical machinery and appliances, which, for the most part, have been obtained in Germany, and the adoption of water power for this scheme has considerably increased the use of electric power in other directions. It is stated in the report that the efficient organization of German firms in the market has secured for them a large share of the general trade, a regular supply of German material having been assured up to the present by the fact that original plant installations were largely of German origin and also that in many cases German engineers have been in charge of large stations.

Table VIII.

IMPORTS OF VARIOUS ELECTRICAL MATERIALS INTO SOUTH AFRICA IN 1913

	From United Kingdom.	From Germany.	From Austria.
	£	£	£
Cables and wire	170,000	71,000	2,000
Fittings, including posts	155,000	67,000	1,000
Electrical machinery	142,000	253,000	....
Telegraph and telephone material	10,000	1,000	....
Tramway rails	2,000	14,000	....
Tramway rolling stock	16,000	1,000	....

Under the heading "British vs. Foreign Machinery," the Board of Trade makes this significant statement,—

British vs. Foreign Machinery

"The reason why foreign manufacturers have been more successful than British firms in the trade in electrical machinery and accessories is not far to seek. The former, as a rule, carry good stocks, and mines are consequently not kept waiting for deliveries. Moreover, they employ as local managers, and engineers, men thoroughly equipped both with commercial and technical experience, the result being that their representatives are able to place full details of their offers before buyers, without reference to their principals oversea. If it could be said that the material supplied by foreign firms was bad, this would account for lower prices consistently quoted. But, except in a few specific cases, the

plant is good and is said to be equal in quality to that of British make, although perhaps lighter in non-essential parts. This ability to underquote must be due to the reduction of works costs, effected by an increased output, or to better shop-organization."

It would appear that the electrical possibilities in South Africa are very great, and that this has been more fully realized by the Germans than any other nation. For example, in three-phase motors, generators and accessories for surface and underground requirements, it is shown that Germany has supplied 70 per cent., the United Kingdom 20 per cent., and the United States 10 per cent. of the requirements in a recent year. In electric winding engines for surface use and underground for multi-stage haulage, goods of German manufacture to the extent of 80 per cent. have been supplied, the remainder being of British make. In electrically-driven pumps, the business seems to be about equally divided between America and Great Britain, not much going to the continent. In electrically-driven air compressors, Germany has supplied 60 per cent., Britain 30 per cent., and the United States 10 per cent. In the matter of steam locomotives Great Britain appears to hold the field against all competitors. Regarding heavy section rails used for surface and shaft track, Germany has supplied 60 per cent. and Britain very little. It would appear that the steam turbine is rapidly gaining ground as the most satisfactory type of prime mover, and for smaller plants the vertical high speed steam engine directly coupled to three-phase generator. Three-phase equipment is now almost universally used.

Australia

The statement herewith (Table IX.), of the imports of certain classes of electrical goods into Australia in the year 1912, gives a fair indication of the amount of German and Austrian trade with which other manufacturers have had to compete. In electrical machinery, including dynamos, and starting and regulating apparatus, the effects of both American and German competition have been felt. British imports show a decline during the years 1910, 1911 and 1912, especially in the larger size machines and in starting and regulating machinery, though the value of the importation of this equipment is comparatively small. In electrical and gas appliances trade with the United States shows a very rapid increase, which is materially overhauling the lead which Germany had held for some time. Out of trade in lamps and lamp wares to the amount of approximately £200,000 in 1912, Britain supplied a little over 42 per cent., Germany and the United States filling in the balance. British trade also shows a decline in telephone switchboards and appliances during the last three years for which figures are available, and during this time the United States has increased her sales. The greater part of the imports of these appliances come from Sweden, however.

Table IX.

AUSTRALIA'S ELECTRICAL IMPORTS

	From United Kingdom £	Germany. £	Austria £
Dynamo-electric machines up to 200 h.p.	185,000	50,000	1,000
Ditto, over 200 h.p.	30,000	2,000	....
Regulating, starting, and controlling apparatus	26,000	8,000	....
Electric fittings of metal or part of metal	45,000	10,000	....
Electric and gas appliances	129,000	48,000	4,000
Accumulators and batteries, arc lamps, covered cable and wire, electric vacuum tubes, measuring instruments, insulating tape, etc.	586,000	59,000	1,000
Arc lamp carbons	1,000	18,000	....

In connection with Australian trade, it is interesting to note a recent report of H. M. Trade Commissioner regarding price-cutting by the German companies. This report says: "My informant stated that, in order to get their turbines on the market here, this German company sent out to their agents five turbines with instructions to sell them under cost." The manufacturing company mentioned is one well known, with headquarters in Berlin.

In the matter of porcelain insulators, keen competition has been met from Germany, Austria and more recently from Japan. In cables British goods have the quality, but so far their prices have been some 20 per cent. higher than the German prices, and there is now a considerable competition from Italian cable made to British specifications. In wire-drawn filament lamps the chief competition comes from the Phillips Company, of Holland, but there is also keen competition with German and Austrian makes. Apparently there is no local factory.

A significant paragraph appears with reference to the glassware for electrical fittings. This paragraph runs as follows: "With regard to glassware for electrical fittings, the British position is weak and has been described by one importer as hopeless. Germany and Austria have most of the trade, their prices being about half what the British firms charge."

New Zealand

The development of electrical enterprises in New Zealand has made rapid strides during the last few years. Vast supplies of water power readily available for the generation of electricity exist, some of which the government have already surveyed with the intention of utilizing them in the near future. In view of these possibilities, it is reported that German firms have made strenuous efforts to secure original contracts for the installation of their equipment, which would help to make a regular supply of materials from German sources more certain. It is frequently pointed out in the report, from which we are quoting liberally, that when it is hoped to secure contracts, put up to tender especially, representation in the market is a vital necessity. As the execution of works is often urgently required before tenders are called for, it is impossible to give a long enough tender period to permit of firms making offers, unless they can do so by cable through an agent.

H. M. Trade Commissioner in New Zealand raised a question of considerable importance in connection with the attitude of the British manufacturer towards their own products. After making it perfectly plain that the one great asset of British machinery is its merit, the commissioner adds, "To sell goods and not to be willing to take any responsibility for their quality after they have left the works may seem sound business, but it may at times also be interpreted to mean lack of confidence in the real value of the goods delivered. It is a common practice to consign goods to an agent and to draw on him in full against documents, or at short sight, irrespective of the purpose to which the machinery is to be put. I would state bluntly that any maker who values his reputation and that of his machinery will not consider any sale transaction closed until that machinery is in use and giving satisfaction. In cases where there is delay in getting the plant installed and working, wherever the fault lies and whatever the normal terms of agency may be, the manufacturer should work loyally with his agent and take the responsibility for his goods. Confidence begets confidence, and in the ideal agency, the agent has a feeling of esprit de corps and loyalty to his principals."

This would appear to be valuable advice, and the neces-

sity of giving it probably explains in no small measure the presence of keen competition at other points as well as in New Zealand where the British manufacturer ought to be supreme.

India

According to the best available reports, electrical machines were imported into India in 1912 to the value of 3,613 rupees (rupee equals about 32.5c.). The future is bright for water power machinery. The total number of electric plants in India is already large, and this number is rapidly increasing. To date the greater part of the trade goes to the United Kingdom, with Germany and the United States not yet strong competitors.

Egypt

The only available report states that there is a considerable demand in Egypt for motors and dynamos. The value of the imports in 1912 amounted to £418,494. The competition is keen from Switzerland, but Germany and the United States have been pushing their trade recently.

China

According to a recent report the demand for electrical apparatus in China is showing a steady expansion. American and Japanese firms, among others, have shown some activity. Supply stations are beginning to install electrical equipment and the development of mines is said to be worth the attention of electrical firms.

A report regarding Shanghai shows that German products were slightly in excess, with Great Britain second and Japan third. The use of the telegraph and telephone is also developing in China, and here again Germany appears to lead in the matter of supply, with Great Britain and Japan in second and third places, as before. Similarly, the American Consul at Hong Kong reports that supplies for electrical concerns in the vicinity of that city come chiefly from Germany, as a result of low prices, with which the American manufacturer cannot compete. American, German and British lamps are sold and American fans are almost exclusively used.

Apparently in China the needs of the licensed and skilled electrical contractor have not yet been keenly felt. Wires are usually carried over the surface of walls and ceilings, the local current being of low power.

Table X.

JAPAN'S ELECTRICAL IMPORTS

	From Germany. £	From United Kingdom £
Insulated electric wires	141,866	49,134
Wattmeters	14,943	2,953
Water turbines and Pelton wheels	61,259	3,699
Dynamos, electric motors, etc	146,037	103,547
Incandescent electric lamps	23,820	613
Telegraph and telephone instruments.	1,003	1,080
Ampere meters and volt meters	5,480	2,863

Japan

The near future promises that Japan will be one of the most highly developed countries in the world regarding hydro-electric developments. A recent trade report gives the number of large hydro-electric undertakings under construction in 1913 and 1914 as 13, in which a total of 43 units are being installed, varying in size from 11,250 h.p. down to 1,000 h.p. For these stations the turbine machinery is divided between Germany, Switzerland and Sweden; the electrical machinery between Germany, England, Sweden, Japan and the United States, the six largest units of 11,250 h.p. being the only ones supplied by England. The transmission line material is divided between Germany and Japan with Germany getting the lion's share.

The same report contains a list of four large hydro-electric plants for which enquiries have been issued, but orders not yet placed. These will require nine units, varying in size from 4,000 h.p. down.

The following figures (Table X.) show the proportions of imports of certain classes of electrical goods into Japan from Germany and from the British Empire during 1913.

Corea

Only a small number of fair sized central companies are operating, and although British electrical machinery is not as largely represented in Corea as could be wished, nevertheless, a considerable portion, especially prime movers and boilers, are of British manufacture. British machinery is recognized to be of highest quality, but reasons of economy have led purchasers to seek cheaper markets in Switzerland and elsewhere.

Manchuria

A special commissioner recently appointed by the London Board of Trade made some significant remarks regarding the granting of credit at this point. It would appear that German goods are more popular on account of the fact that almost unlimited credit is given, while British firms insist on cash payments, and the following instance is cited:—"The city of Shuang Cheng Pu ordered a small electric light plant through a German firm, valued at £20,000. The terms were three years' payment, one-third each year." The report adds that this confidence is well placed, as bad debts are very few.

Norway

The manufacture of electrical machinery apparatus in Norway is increasing very rapidly, not only in extent, but also in variety. Germany formerly sent nearly all such goods to Norway, but home manufactures have decreased the imports considerably. Of the equipment still brought in the majority is from Germany, with smaller quantities from the United States, Sweden and England. On account of the large water power resources of Norway, this country, as is well known, bids fair to be one of the largest manufacturing and consuming countries, from the point of view of electrical apparatus, in the world. In the meantime it would appear that the field for smaller electrical appliances is very great, and this chiefly on account of the low prices almost universally charged for electric current.

Sweden

Imports into Sweden from foreign countries are considerable, including lamps, sockets, insulators, wiring materials and fixtures, which come chiefly from Germany. Larger electric supplies are, of course, very extensively manufactured in Sweden. It is said that the demand is rather for cheap articles, which is explained by the fact that individual dwellings are few, and, comparatively speaking, the number of householders small. Here again, German manufacturers have adopted long terms of credit or a liberal discount for cash payment.

It is encouraging to note that great progress has been made in Sweden regarding the installation of wiring and wiring devices. In most of the buildings now being erected the wires are concealed within the walls and ceilings, and for better protection metal-covered conduits, both lead and steel, are in general use. The municipal laws of Gothenburg, for example, require that a contractor must have a special license before he can undertake to install electric wiring.

Importers and dealers are warned that the Swedish people are only familiar with the metric system and that figures should be quoted accordingly. It is further noted that the tendency of municipalities and central stations in Sweden

is to obtain supplies from Swedish manufacturers wherever possible.

Portugal

It is understood that Germany is sending more electric plant into Portugal than is the United Kingdom, although reliable statistics are not available. German equipment is lighter and therefore cheaper, not being designed to withstand the severe tests put upon their equipment by British manufacturers.

Spain

A very considerable trade in electrical equipment has developed recently in Spain on account of the utilization of vast available water powers. At present Germany has the lead of every other country, so that it is plain that this market now offers a favorable opportunity for British firms to secure some of the trade which had previously been controlled from Germany. It is said that the Germans have strengthened their hands in the past by sending out competent engineers, who also had an intimate knowledge of the Spanish language and customs.

Table XI.

SPAIN'S IMPORTS FROM GERMANY AND BRITAIN

	From Germany Pesetas.	From United Kingdom Pesetas.	Total Pesetas.
Dynamos, etc., up to 400 kilogs. weight	3,692,000	568,000	5,457,000
Ditto, from 401 to 2,500 kilogs.	3,054,000	430,000	4,616,000
Ditto, from 2,501 to 5,000 kilogs.	496,000	....	1,107,000
Ditto, more than 5,000 kilogs.	4,026,000	165,000	5,073,000
Accumulators and batteries	104,000	7,000	220,000
Cables and wires	1,273,000	1,029,000	2,639,000
Telegraph and telephone apparatus, electric motors, and parts	1,122,000	204,000	1,966,000
Arc lamps	157,000	10,000	202,000
Incandescent electric lamps	4,733,000	334,000	5,791,000
Hydraulic motors	1,135,000	7,000	1,563,000

The increased use of electricity is exemplified in the single item of incandescent lamps. In 1908 the value of the imports of these lamps amounted to 900,000 pesetas (peseta equals about 20c.), but by 1910 this had increased to 2,300,000 pesetas, and in 1912 to 5,791,000 pesetas. This demand has, of course, resulted in the establishment of local factories, but the market for foreign goods still increases. A recent report states that there is a good and increasing demand in Spain for such equipment as electric motors and dynamos, telephone and telegraph apparatus and electrical meters. Table XI. shows the imports in the various departments from Germany and the United Kingdom for the year 1912.

Italy

There appears to be a great future in Italy for the smaller electrical devices, chiefly for household use. Electric current is available very generally. Goods are being imported up to the present time in large quantities from Germany, and home manufacture on a small scale has been commenced.

Poland

This is a case where, owing to the proximity to the home market, the trade is almost entirely in Germany. It is said that the German success has been further assisted by an intimate knowledge of Polish and Russian trade conditions, which they have been quick to take advantage of.

Roumania

Imports are considerable, the principal being from Germany and Austria-Hungary, with a small portion coming from France. Thanks to the low prices which German manufacturers quote, and to the fact that the greater number of electrical companies are of German origin, most of the supply business has been taken care of by the latter country.

Greece

It is said that large electrical installations are now being carried out and others are projected. Large installations also in the department of telegraphs and telephones are among those projected for which a large quantity of material will be required. Local manufacturers supply much of the material, but this is supplemented by dynamos, motors, transformers, etc., from France and by transmission wire from Switzerland. Transmission line material also has been supplied by Belgium and other equipment from England, Sweden, Austria and Hungary. It is said that the dealers' supplies in general, in which there is a considerable trade, are furnished chiefly by Germany.

Turkey

It is only within the last four or five years that electricity has obtained a foothold in Turkey, but it is making rapid progress, and at the present time an extensive plant is in course of installation in Constantinople, including electric tramways which will connect with outlying points. Up to the present time the public have not enjoyed the privilege of telephones, but this matter is being remedied. Considered as a whole, Germany supplies about 70 per cent. of the electrical requirements, France 20 per cent., and Belgium 10 per cent. England scarcely seems to be represented except in the matter of supplying a few lamps.

Syria

The use of electricity for lighting purposes and industrial activities is increasing and a considerable demand for electrical equipment has developed. Transmission wire in the past has been imported from Germany and France. Incandescent lamps have been imported from Germany, Great Britain and France. Electric fans were brought from Italy.

Argentine Republic

In 1911 roughly one-half of the total imports of electrical appliances were from Germany, only one-quarter coming from the United Kingdom. Re-imports from Britain have showed a tendency to decrease and those from Germany to expand, which is partly accounted for by the fact that German manufacturers have either agents or branches carrying large and varied stocks in Argentina. German manufacture predominates greatly in accessories, including insulators, wires, cables, lamp carbons, dynamos, motors, electric meters. A number of small motors, insulators and accessories come from the United States, and Great Britain sends wires, cables, dynamos, motors, accessories and meters. Italy supplies ventilators, cables and wires. A recent report contains this significant remark: "It is hardly likely, in view of the strong competition, that new equipment can be introduced here through mere correspondence. Goods that are finding a demand have been placed on the market through personal efforts of travelling salesmen and agents. Where two articles are in competition, that which is backed by personal effort has every advantage over the article which depends only on catalogue advertising. Experience in this territory shows that the distribution of catalogues produces very meagre results."

The same remarks could doubtless be applied in numerous other instances where British trade is slack.

Honduras

On account of its proximity to the United States, American manufacturers have been showing more active interest during the recent past. German commercial travellers have also been very active. The British, however, have a strong

hold, and can increase their consumption if they will handle the market judiciously. The British manufacturers are criticized in that they do not state in a sufficiently concise form the substance and quality of their goods, giving a few prices of their special lines. It is also complained that they show a marked lack of originality in their printed matter, much of it containing absolutely no information as to what the nature of their business is and in some cases being so technical as to be scarcely intelligible. It is further stated that American and German manufacturers seem to have made a special study of these matters, and that they are meeting with good success. These matters are reprinted merely as suggestions which some firms may find it to their advantage to take note of.

Chile

It is represented that practically all the electric light companies of the district are German, and that they favor German supplies whenever possible. The English language is not generally understood.

Ecuador

H. M. Charge d'Affaires of Quito recently advised that many municipalities in Ecuador intend to introduce electricity, thus opening a market for small electric plants, lamps and electrical accessories. Correspondence must be in Spanish.

Venezuela

The American Consul reports that the electrical supplies are mostly from the United States, though certain foreign appliances are also used. Electrical installations are very simple, wires being carried openly on the walls and ceilings in the easiest possible way.

Canada

Electrical requirements in Canada are increasing at a very rapid rate. This has been due not only to numerous water power developments which are being prosecuted at many points in the Dominion, but to the rapid opening up of Western Canada, which is destined to become one of the greatest, if not the greatest, wheat producing country in the world. The introduction of electric plants of the smaller type has been very noticeable in the smaller towns that have grown up throughout Western Canada. In the east, and especially in certain sections of the province of Ontario, where the Hydro-electric Power Commission, operating under the Ontario Government, has succeeded very greatly in reducing the rates to consumers, there is now an almost insistent demand for the smaller classes of electrical equipment, largely household, and especially, at the present time, for electric ranges at a price which the average consumer can reach.

In spite of the fact that Canadian manufacturers are actively engaged in meeting the demands of the home market there is annually a considerable amount of electrical equipment imported into Canada. During the year ending March 31st, 1914, equipment totalling approximately $9,000,000 in value was brought into the country. The source of supply of this imported equipment is chiefly the United States, which both by proximity and by similarity in practice, appears to possess advantages that can not easily be met by any other country. Indeed, not only is it true that American manufacturers have been most favorably situated to meet the requirements of Canadian customers, but on account of the previously limited demand for electrical equipment in Canada and the comparative difficulty of obtaining it elsewhere, the American manufacturer has been able practically to control the lines along which the Canadian demands should develop. This is an added reason why our neighbors to the south have been in a position to compete favorably with the countries of continental Europe in supplying us with our electrical needs. It is not a foregone conclusion, however, that the Canadian specifications are as fixed as the laws of the Medes and Persians and, even if they were, there is not sufficient difference between Canadian and British practice to prevent our purchasing much of our equipment in Britain if the British manufacturer will, perhaps, put himself about a little bit more and study our special requirements.

There is a growing tendency, however, we believe, to develop our home manufactures to the extent that we may be able to supply the great majority of our own requirements,

Table XII.

ELECTRICAL EQUIPMENT IMPORTED INTO CANADA

Articles Imported.	Countries.	Value.
Electric light carbons and carbon points, of all kinds, n.o.p.		$
	United Kingdom	5,247
	Aust.-Hungary	587
	Belgium	222
	France	633
	Germany	43,308
	Switzerland	2,491
	United States	37,368
	Total	89,856
Incandescent lamp bulbs and glass tubing for use in the manufacture of incandescent lamps and mantle stockings for gas light	United Kingdom	1,491
	Aust.-Hungary	13,000
	Belgium	40
	France	1,824
	Germany	4,128
	United States	110,049
	Total	130,532
Electric apparatus, n.o.p., insulators of all kinds and sockets, etc., and electric galvanic batteries; telegraph and telephone instruments	United Kingdom	819,597
	Hong Kong	250
	Newfoundland and Labrador	195
	Aust.-Hungary	8,134
	Belgium	1,040
	Denmark	5,642
	France	28,635
	Germany	141,252
	Holland	56
	Italy	5,966
	Japan	475
	Sweden	81,524
	Switzerland	3,128
	United States	5,522,917
	Total	6,618,811
Electric motors, generators and dynamos	United Kingdom	138,434
	Aust.-Hungary	46
	Belgium	1,771
	Denmark	116
	France	3,664
	Germany	15,700
	Italy	7,143
	Sweden	104,382
	Switzerland	623
	United States	1,542,088
	Total	1,813,967

except in isolated and specialized cases, and on account of our unlimited resources both in power (water, coal and gas) and in raw materials, there does not seem to be any insuperable difficulty in the way of developing our export trade very greatly in the near future, and especially is this true in view of the fact that at the present time, when the trade routes of the whole world are being readjusted, new fields are available which are as open to Canadians as to any other country in the world.

Perhaps sufficient information for our present purpose will be given if we classify electrical equipments imported into Canada under four general headings. This is done in Table XII., which indicates also the different countries from which we receive the various items.

As mentioned above, it will be noted that in every case but one the preponderance is greatly in favor of the United States which, generally speaking, may be said to supply us with between 80 and 90 per cent. of our total requirements.

Canadian Exports

Canadian export trade has not to date been developed as vigorously as could be wished for, or as we trust the immediate future will see it. During the past year our total export in electrical apparatus only amounted to $106,816, made up chiefly of items to the United States totalling $67,000, to the United Kingdom totalling $25,000, to Newfoundland totalling $3,000, to Belgium totalling $2,000. The complete list of exports is given in Table XIII., which we are free to admit shows our export trade to be a somewhat inconspicuous factor in the sum total of world commerce. The very insignificance of these items should be sufficient incentive in itself to warn our government and our factories as to the possibilities for development and the limited extent to which we have taken advantage of our opportunities as yet.

The extent of the market for electrical equipment which must inevitably result with the gradual development of our tremendous water powers, coal areas and gas fields, is treated somewhat more fully at another place in this issue. At the same time, the development of these powers will depend very largely on the coincident establishment of manufactures of various kinds. For this latter our Dominion seems to be particularly well equipped. We speak also of the possibilities of immediate further manufacturing developments in another article in this same number.

Everything considered, the time seems ripe for vigorous and aggressive steps by our manufacturing industries. Not only does it seem beyond question that our own demands will increase rapidly in the near future, but we must also remember the numerous markets that will develop equally with our own. Canada's manufactures should be developed not alone with a view to supplying her own home demands, but also having in mind fulfilling the requirements of other countries less favorably situated for manufacturing than ourselves, but with great consumption possibilities.

Table XIII.

ELECTRICAL EXPORTS FROM CANADA

Articles Exported.	Countries	Value. $
Electrical apparatus	United Kingdom ..	25,183
	Australia	127
	Bermuda	339
	B. W. Indies	35
	Newfoundland	9,158
	Alaska	30
	Aust.-Hungary .. .	25
	Belgium	1,588
	Cuba	19
	France	3,337
	Germany	17
	Miquelon and St. Pierre	74
	Sweden	16
	U. S. of Colombia .	19
	United States	66,849
	Total	106,816

An Entirely "Made-in-Britain" Plant

Engineering and Ship Building Plant of Canadian Vickers, Limited, Montreal —Detailed Description of Electrical Equipment

The recently completed engineering and shipbuilding works of Messrs. Canadian Vickers at Longue Pointe, Montreal, contain the most modern machinery for carrying out this class of work, and a description of the electrical equipment should therefore be of interest.

It is a specially appropriate article for this number of the Electrical News, as practically the whole of the electrical plant was made in England.

The power house, electrical work shop and test house are all in one building. The power house, which is 80 feet long by 66 feet wide, is arranged in two bays, each served by a hand-operated crane with a lifting capacity of ten long tons. The electrical work shop is equipped with the following machines, which are belt-driven from a line shaft run by a 10 h.p. motor of the Electric & Ordnance Company's make:—Double disc grinder, sheet shears and rolls, wet stone, shaping machine, drilling machine, two screw cutting lathes, large machine lathe, coil winding machine, coil taping machine and band saw for cutting insulating material, etc.

A 600 ampere welding dynamo direct coupled to a 40 h.p. Electric & Ordnance Company's motor is installed complete with switchboards and all accessories for electric welding.

The electrical work shop is served by a hand-operated crane, having a lifting capacity of three long tons.

There is also an impregnating plant for treating field coils, armatures, etc., with either varnish or compound. This plant is installed in a separate building close to the electrical work shop. A hand-operated crane with a lifting capacity of one long ton is installed. The hand-operated cranes were all supplied by Messrs. Herbert Morris & Company, of Loughborough, England.

At the present time some 200 direct current motors, totalling about 4,000 h.p., the sizes ranging from ½ to 200 h.p., are installed in the works for driving the various machine tools. Forty-eight of these motors are used for operating electric travelling and jib cranes and a large number are variable speed machines having a range of three to one. These motors are controlled by means of a combined controller, contactor, and speed regulator with all motions interlocked. This control gear was supplied by the Electric & Ordnance Accessories Company. Six large alternating current induction motors are installed at the present time, which will be described later.

Distribution to the motors and lighting circuits installed throughout the various machine shops is on the three-wire

system, giving 440 volts across the outers for the motors, and 220 volts for lighting circuits.

The general lighting of the buildings is by Cooper Hewitt "Silica" mercury vapor lamps, each of about 3,500 c.p. When additional local lighting is required it is provided by ordinary incandescent lamps, plug circuits being provided for this purpose. In practice, however, this is seldom found necessary as the general lighting has proved so effective. In shops and under galleries where the height prohibits the use of so powerful a lamp as the mercury vapor, small arc lamps of about 500 c.p. and high candle power tungsten filament lamps are installed.

For the outside yard lighting mercury vapor lamps are used, suspended when convenient from iron brackets secured

Interior of Electrical Workshop Canadian Vickers, Limited.

to the shop walls, and where this is not possible, from high poles fitted with steel brackets. Forty-two lamps are at present in use for this purpose, average height from ground 35 feet.

The buildings, which, as will be seen from the plan, are grouped around the dock basin, are connected with the power station by a trench 6 ft. wide by 6 ft. deep, which is sunk below frost level. In this trench all electric cables, steam, and water mains are run. Ready access is gained by manholes placed at convenient intervals. The cables are run on porcelain insulators, firmly fixed to stout wood battens, spaced 8 ft. apart. These battens are bolted to the trench wall by large rag bolts.

Electrical supply is obtained from the Montreal Light, Heat & Power Company at a pressure of 11,000 volts, three-phase, 60 cycle, two overhead transmission lines fed from entirely different sources being installed for this purpose. Upon entering the power station, these lines are led through the power company's isolating switches to two incoming feeder panels. These panels consist of a boiler plate structure, mounted on an angle iron frame work, and each is fitted with three single pole, 200 ampere change-over switches, one 300 ampere, triple pole oil switch with triple pole, instantaneous overload trip coils having a breaking capacity of 30,000 kw. The two sets of change-over switches are interlocked and so arranged that the station can only be fed from one transmission line at one time. From these panels the current is led by means of lead covered cables to the 11,000 volt a.c. bus-bars and switchboard. The latter consists of nine panels:—2 transformer panels, 3 11,000-volt, 650 kw. rotary converter panels, 2 2200-volt, 90 h.p. motor panels, 2 2200-volt, 350 h.p. motor panels. The 2200-volt bus-bars and panels are fed from three 500 kw. single phase, 11,000/-2200 volt, water-cooled, oil-insulated transformers, installed for the purpose by the Montreal Light, Heat & Power Company. These transformers are fed from the 11,000 volt supply by means of single core lead covered cable laid underground in fibre conduit. The lead covered cables to the 2200 volt a.c. motors, which, with the exception of one 350 h.p. air compressor motor, are all installed in the power house, are also laid in fibre conduit. In the same way the cables from the 11,000 volt rotary panels are carried to three 720 kv.a. transformers, manufactured by the British Westinghouse Company, Manchester, England, and having a ratio of 11,000/330 volts. These transformers are oil-insulated, self-cooling, and have tappings provided on the primary for 11,500, 11,000 and 10,500 volts, and on the secondary for 320, 330 and 340 volts.

Both the rotary converter transformers and those for supplying a.c. motors are installed on rails in open fronted brick cubicles, making their removal for inspection and repair an easy matter.

From the transformers to the rotary converters, the cables are rubber insulated, braided and compounded and run in a trench with branches finishing inside the bedplate of each machine. The top of the trench is covered by portable chequer plating.

Three rotary converters are installed, each have a capacity of 650 kw., 6 phase, 60 periods, voltage on the a.c. side 320, and on the d.c. side 440/460. The neutral connection is taken from the transformer. The machines are shunt wound and self synchronising. A 60 h.p. one minute rated motor

General view of plant of Canadian Vickers, Limited, Montreal, where 200 d.c. motors are already installed.

direct on the same shaft is used for starting up. Mechanical oscillators giving uniform commutator wear are fitted to each machine. The machines run at 720 r.p.m. and were manufactured by Messrs. Vickers Limited, Sheffield, Eng. A starting panel is fitted near each machine containing voltmeter, triple pole 200 amp. quick break knife switch for starting motor, triple pole 600 amp. quick break switch for the rotary, three contact 300 amp. knife switches for neutral connection. These panels are of black enamelled slate and have expanded screens to entirely enclose them. They were manufactured by Messrs. Ferranti, Limited.

From the d.c. side of the rotaries, rubber insulated cables are run in a trench to the d.c. switchboard. This board consists of 12 black enamelled slate panels as follows:—three 650 kw. rotary panels, each fitted with one single pole overload circuit breaker carbon break for 1500 amps.; one single pole overload and reverse carbon break circuit breaker for 1500 amps.; two ammeters reading 0/2000 amps.; two single pole 1500 amps. isolating switches for outers, field switch regulator, etc. Three feeder panels having a capacity of 1,000 amps. each for the engine and boiler shop, iron workers' shed and building berth; each panel equipped with two single pole 1,000 amps. overload circuit breakers carbon break; two ammeters reading 0/1200 amps.; two 2-wire 1000 amp. watt hour meters; two single pole 1000 amps. isolating switches for outers. Five feeder panels having a capacity of 600 amp. each. (1) north fitting-out berth and capstans; (2) south fitting-out berth and capstans; (3) woodworking shops; (4) power house, electrical shop, heating station and stores; (5) yard lighting.

These panels are each fitted with two single pole, 600 amp. overload circuit breakers carbon break. Two ammeters reading 0/800 amps. Two single pole isolating switches for outers. Two 2-wire, 600 amp. watt hour meters.

There is also one summation panel equipped with earth leakage indicating and testing instruments, also central zero ammeter reading 250-0-250 amp. for indicating out of balance current. The neutral cables are in each case connected direct to the neutral bus-bar through isolating links.

In addition, two illuminated dial sector pattern volt meters reading 0/500 volts are mounted on a swing bracket attached to one end of the d.c. board, one reading machine voltage and the other bus-bar volts.

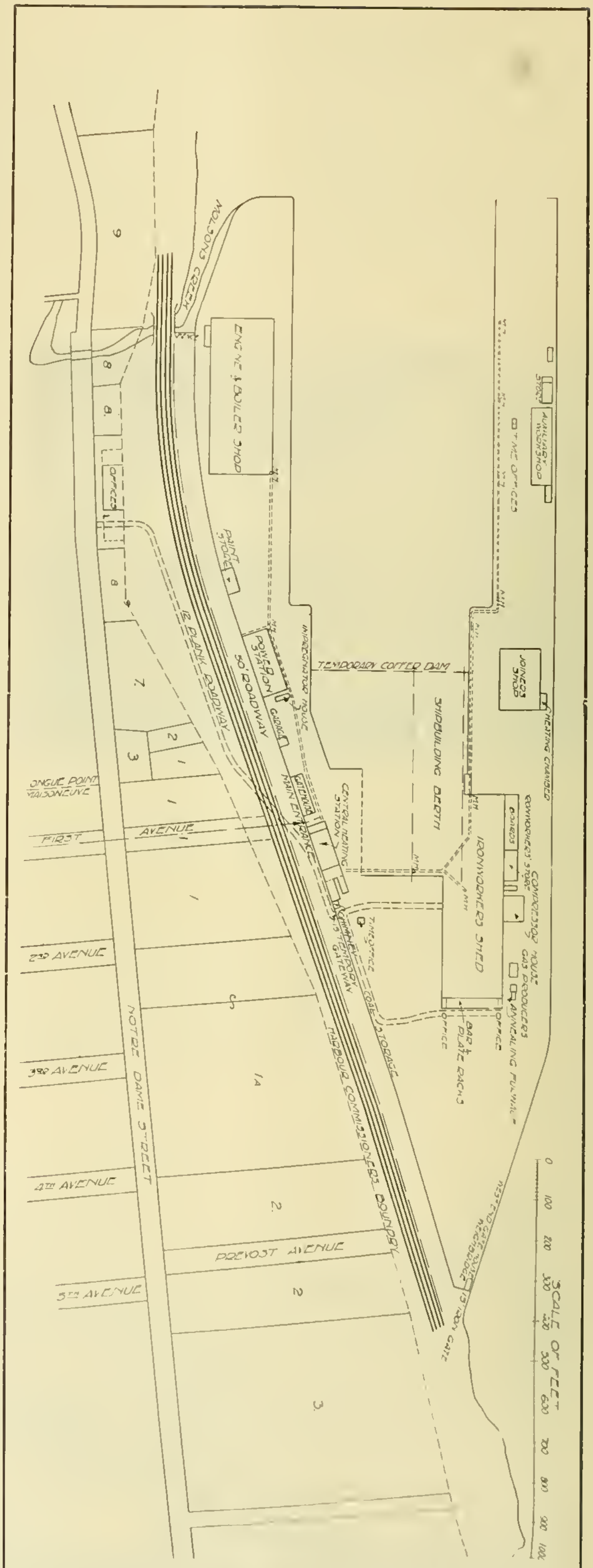
A feature of this switchboard is the ease with which any panel can be isolated for repair or alteration by means of the special isolating links provided on each. The whole of the a.c. and d.c. switch gear was supplied by Messrs. Ferranti Limited, Hollingwood, England.

For the hydraulic installation two horizontal three-throw ram pumps are installed in the power house, each gear driven by 2200 volt, 90 B.h.p., 3-phase, 60 cycle, slip ring induction motors running at 495 r.p.m. These motors are of the semi-enclosed type, and were manufactured by Messrs. Vickers Limited, Sheffield.

Two sets of automatic control gear by Messrs. Electric Control Company, Glasgow, are installed for controlling the motor.

This gear consists of an arrangement of solenoid operated switches, controlled by tappet switches fitted on the hydraulic accumulator and controls the rotor circuit of the induction motor, also magnetically operating a valve on the hydraulic pumps, allowing them to start and stop on no load. The control current is taken from an 8 kv.a., single phase transformer, having a ratio of 2200/400 volts. The primary of this transformer is connected to the 2200 volt bus-bars.

Two air compressors are in use at the present time, one installed in the power house for supplying the engine shop, etc., and one in the plater's shed for supplying the shipbuilding side. Both these machines were manufactured by Messrs. The Canadian Ingersoll-Rand Company, Sherbrooke, P.Q.,



Plan showing general layout of Canadian Vickers plant.

and are driven by 350 h.p., 2200 volt, 3-phase, 60 cycle, slip-ring induction motors, supplied by Messrs. Vickers Limited, Sheffield. The rotors of these motors are mounted direct on the crank shaft of the compressors and run at 150 r.p.m.

An oil immersed starter by Messrs. Ellison is installed for each motor.

A single acting vertical triplex pump driven by an 8 h.p. motor is installed in the power station for lifting water from the basin for supplying boiler feed water and cooling water for the air compressor and 11,000/2200 volt transformers. The motor is compound wound and runs at 1220 r.p.m., it is controlled by a Cutler-Hammer automatic starter operated by a float switch.

Distribution switchboards are installed in the ironworkers' shed, engine and boiler shop, and building berth. These are fed direct from the panels on the main switchboard.

The ironworkers' shed contains approximately 800 h.p. in direct current motors. Starters or controllers for these motors are mounted near the machine they control, either on walls or columns. Cables from distribution switchboard are run on porcelain insulators mounted on brackets to 440 volt distribution boxes for motors and to 220 volt distribution boxes for lighting circuits. Cables from starters to motors are in most cases run in screwed galvanized conduit underground. The cable used is rubber insulated, braided and compounded.

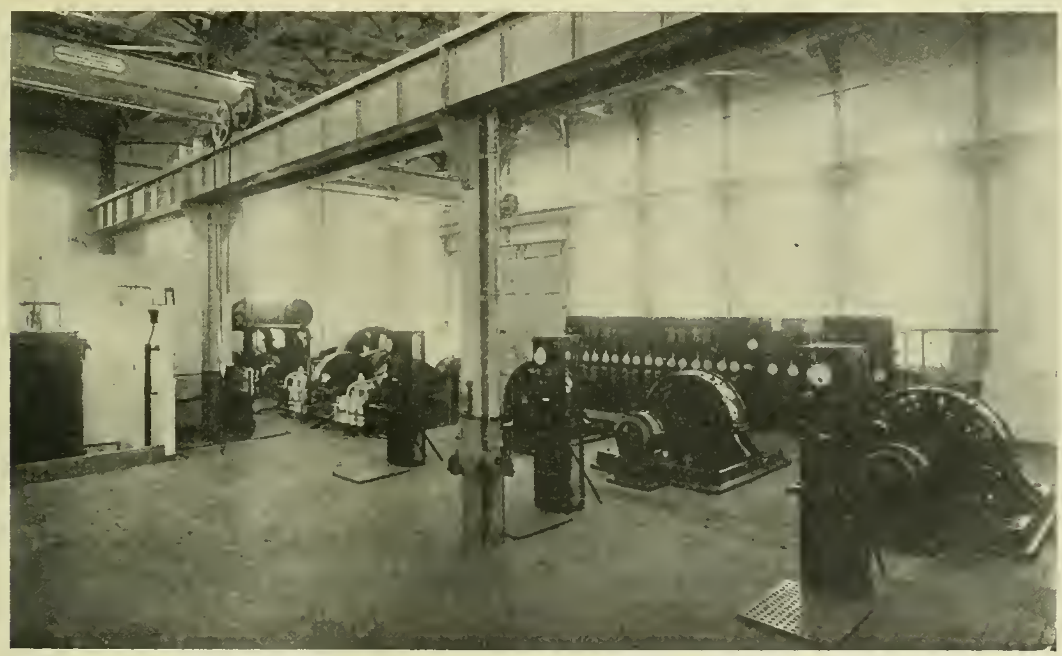
The whole of the motors throughout were manufactured by Messrs. The Electric & Ordnance Accessories Company, Limited, Birmingham, Eng., and Messrs. Vickers Limited, Sheffield, England. All are of the semi-closed type and amongst them may be mentioned the 200 h.p. one hour rated machine driving the large set of plate bending rolls. This machine is series wound, fitted with interpoles, and runs at 525 r.p.m. It is controlled by a 200 h.p. liquid reversing controller by Messrs. J. P. Hall & Company, Oldham, England. The raising and lowering gear on the same rolls is operated by two 40 h.p. 1-hour rated series motors running at 660 r.p.m.

The engine and boiler shops, which are located in one building, contain approximately 600 h.p. in motors, installed in a similar manner to those in the ironworkers' shed.

A complete electrical galvanizing plant is installed in the boiler shop, comprising a 6/8 volt 1500 amp. dynamo by Messrs. Canning & Company, Birmingham, Eng., direct coupled to a 15 h.p., 650 r.p.m. motor. Switchboard with knife switches, voltmeter and ammeter for the dynamo manufactured by Messrs. Verity's, Manchester, England, who are also the makers of the distribution switchboards installed in the engine and boiler shops, building berth, and ironworkers' shed.

Two motor generators for supplying temporary lighting on ships at the fitting-out berth are provided. These machines consist of a 40 h.p., 440 volt, shunt wound motor, coupled direct to a 300 amp., 60/110 volt, shunt wound dynamo. These machines run at 1200 r.p.m. and were manufactured by Messrs. The Electric & Ordnance Accessories Company, Limited. Panels carrying motor starter, meters, and switch gear will be mounted on a narrow gauge bogie, together with machines so that they may be easily moved about the works.

The four and six-way, 440 volt power distribution boxes used throughout the works were made by Messrs. The Electric & Ordnance Accessories Company, Limited; 220 volt, four and six-way lighting distribution boxes by H. G. Mabbs, Manchester. Three standard sizes of double pole switches and fuses are in use on the various motors—25 amp., 50 amp., and 100 amp. and were made by Messrs. Verity's Limited. Compression type starters made by Messrs. Ferranti Limited, are used in all cases when controllers are not installed.



Power House of Canadian Vickers, Limited—Contains 3-650 kw. rotary converters, transformers, motor driven pumps, witchboards, etc.

For general lighting in the yard when the power house is shut down a 2200/220 volt, single phase transformer has been installed in the ironworkers' shed compressor house. This transformer is fed from the fire service motor mains and supplies clusters of 100 watt tungsten lamps suspended from brackets mounted at a height of about 15 ft. from the ground on the same poles as the mercury vapor lamps. These clusters are only installed at important points. This transformer also supplies the general stores building with current for lighting, etc., and in addition a 15 kw. electric annealing furnace supplied by Messrs. The Rudel Belnap Machinery Company.

The company's administration offices are supplied with current for lighting, heating and ventilating from the ordinary 220 volt a.c., single phase, 60 cycle mains of the Montreal Light, Heat & Power Company.

For supplying the various hydrants and sprinklers installed throughout the works for fire service, two vertical turbine centrifugal pumps, each capable of delivering 1,500 gallons per minute, are installed in a pump house situated

on the bank of the St. Lawrence. Each pump is driven by a 260 h.p., 3-phase, 60 cycle, 220 volt, 1160 r.p.m., vertical slip-ring induction motor direct coupled. The pumps were supplied by Messrs. R. H. Buchanan & Company, Montreal, and the motors made by Messrs. Vickers Limited, Sheffield. Supply is taken from a 2200 volt transmission line installed by the Montreal Light, Heat & Power Company for this purpose. An alternative supply can also be taken from the power station. For this purpose change-over switches are fitted, making it possible to put either the shipyard air compressor motor or fire pump motor on the power house supply. Control of one of the motors is by Messrs. The Electric Control Company's automatic control gear, similar to those fitted on the hydraulic pumps in the power house and already described. A hand-operated, oil-immersed starter, made by Messrs. Ellison, is also installed for starting the second motor.

Nine three-motor electric travelling cranes manufactured by Sir William Arrol & Company, Glasgow, are installed in the engine, boiler shops, and shipbuilding berth. In the ironworkers' shed seven three-motor electric jib cranes by the same maker are in operation. The electrical equipment for these cranes was manufactured by the Electric & Ordnance Accessories Company, Limited. The size of the cranes varies from 5 to 35 tons.

The floating dock which is moored in the basin has an entirely independent electrical installation for supplying its own lighting and power. Two 440 volt, 45 kw., shunt wound, 3-wire, "Vickers" generators, direct coupled to high speed enclosed engines by Messrs. Matthew Paul & Company, Dumbarton. The generators are fitted with static balancers. One set is installed on each section of the dock. Provision is made for shore connections, so that current can be taken from or supplied to the works if necessary. The general lighting is by 500 watt tungsten lamp clusters suspended from deck standards mounted on the dock walls. For repairs to ships, cargo lights are used, supply being taken from plug boxes installed for this purpose.

For operating the dock and ships, four electrical-driven, double headed capstans are installed, one at each corner of the basin. These capstans were manufactured by the Chatteris Engineering Company, and have a hauling capacity of 12½ tons at a speed of 30 feet per minute from the smaller head, and six tons at a speed of 60 feet per minute from the larger head. Each is driven by a series wound, 1-hour rated, 40 h.p. motor, manufactured by the Electric & Ordnance Accessories Company, Limited. The motor is controlled by a reversing controller by the same maker. Electrically-operated brakes are fitted on the motors, the coils of which are excited from special contacts provided on the controllers.

Canada's Electricity—Who is to Have It?

The statement made by Mr. Arthur V. White (Consulting Hydro-electric Engineer with the Commission of Conservation, Dominion Government), dealing with the problems arising out of the international power situation, published in our issue of February 1st, has been received with much interest. In that issue we gave Mr. White's statement at length. Inasmuch, however, as the matter is one of special importance, we take this additional opportunity of making brief editorial reference to that part of the Statement which deals, more particularly, with the subject of markets for electrical energy generated in Canada.

Mr. White calls attention to the fact that a number of Bills relating to hydro-electric development on the Niagara River have been presented of late to the United States Congress. These measures contain certain provisions which cannot fail to be greatly inimical to Canadian manufacturing interests. Emphasis is laid on the fact that the possibility of trouble lies not with the people, but with the aggressiveness of certain powerful United States commercial interests which are seeking to bring about the importation into the United States of increased quanitities of electrical energy generated in Canada. The whole matter is set forth very clearly in Mr. White's paper, which discusses the Smith Bill and the Cline Bill (two measures dealing with the Niagara waters), which provide for the importation of electricity from Canada into the United States, and make certain provisions in regard to the methods by which water may be diverted from the Niagara River for power purposes. We are reminded that the Burton Act, which for years very definitely restricted both the diversion of water and the importation of electricity into the United States, expired in 1913. Under this Act Canada enjoyed some protection. The whole matter is covered very fully in Mr. White's statement, which commands the careful perusal of those interested in the subject, but we cannot let such an occasion as a British Empire Number pass without adding our own quota to a discussion of this character.

Canada's great power resources constitute the life-blood of her industrial progress. If we draw upon that life-blood by exporting power to the United States, without an adequate quid pro quo, our neighbors across the line will fatten at our expense, while the manufacturing achievements of the future will suffer vastly in their proportions. Mr. White shows us very clearly what the sentiment is in the United States. It is important to notice in his statement that he does not rest his argument upon his own surmise or conjecture, but quotes the statements of leading authorities in the United States, regarding the advisability of that country's speedily importing larger quantities of electrical energy.—[Editor].

* * *

STATEMENT BY MR. ARTHUR V. WHITE

The United States Fears that Canadian Markets May Absorb Electricity

An object avowedly sought to be attained by some of these measures, is **the importation into the United States of increased quantities of electrical energy generated in Canada.** It is abundantly evident that the motive prompting the early passing of such legislation is the fear that the longer the delay that occurs in actually receiving electrical energy from Canada, the less will be the amount that may be so received; because Canada, owing to her growing manufactures and demands, is rapidly absorbing the surplus energy which is coveted chiefly for the State of New York.

Consider some confirmatory testimony upon this matter: Lieutenant-Colonel J. C. Sanford, reporting on January 6th, 1913, upon the subject of Niagara power, to the Chief of Engineers, United States Army, states:

"There is no question but that Niagara power will soon be utilized to the fullest extent allowed by governmental restrictions. If advantage of the power, generated in Canada, cannot be had on the American side, manufacturers will be attracted to Canada by this cheap power, and the industries of this country will suffer accordingly. The effect of present restrictions on the importation of power is becoming noticeable. . . . **Manufacturers at present contracting for additional Niagara power must locate and are locating in Canada. It therefore seems advisable to permit immediately the importation of Niagara power to the fullest extent permissible under the law,** and, other things being equal, to grant

permission for its importation to the company or companies which will make the earliest use of such power."

The former Secretary of War, Honourable H. L. Stimson, before the Committee on Foreign Affairs, recently stated that:

"The investigation which has been made by the Engineers indicates that Canada, if we do not take it, will use the entire amount that the Treaty permits in a very brief time, so that whatever effect any restrictions on importation would have, would not protect the falls for more than a very brief period, and it would result in giving to Canada, very possibly, a large number of industries which otherwise would be established on this side of the falls."

When Representative Chas. B. Smith was speaking on behalf of his Bill, he submitted, before the Committee on Foreign Affairs, a letter from a leading citizen of Buffalo, in which it is stated:

"Every restriction on the importation of Canadian power should be at once removed. Electrical power is a raw material and should be free.

The Sub-Committee on Niagara Falls power, appointed by the Committee on Foreign Affairs, in their report on one of the Cline Bills, state that it had been urged for their attention:

"That the Canadian companies were rapidly increasing their sales and would very soon take the full amount of water they were entitled to and United States ought to get what power it was able to now."

and they add:

"If the advancement in the development of power on the Canadian side increases for another year or so—and it is not apparent to the Committee that it will not, then the Committee concluded that it was proper to take as large an amount as it could get for consumption in the villages, cities, factories and homes along our border."

Representative Chas. B. Smith, of the State of New York, in conversation, stated to me, that he favored no restriction on the importation of electricity, because if it was good for United States to have this commodity he thought it was advisable to get as much as possible, and permit it to come into the country without any restrictions. This view of Mr. Smith is amply reflected in certain bills of his which provide for no restriction.

International Complications Possible

Canada, naturally, desires to avoid contributing to any circumstances which might have within them the possibility, later, of creating difficulty with any foreign nation, and especially any difficulty with the Republic on her southern border.

The chief danger lies, not with the peoples themselves, but with the aggressiveness of powerful United States' commercial interests whenever they fear their assets are jeopardized.

In the Opinion just rendered by the Public Service Commission of New York, the Commissioners state:

"We have nothing before us but the suggestion that the Dominion of Canada may at some future time forbid this exportation. This Commission must assume that international relations affecting so important a subject as the means of continuing great industries which have grown up in reliance upon the use of this imported power, and as well the interests of the Canadian producing companies themselves have become fixed and subject only to such changes as will fully protect the great commercial and industrial interests and rights now served by this power brought from Canada. The time has long since passed when governments proceed ruthlessly from pure national rashness or anger to destroy the settled accepted commercial relations and formally vested rights of persons and corporations."

Elsewhere the Commissioners also state that:

"In deciding these cases the Commission must assume that relations between Canada and the United States affecting the means of continuing great industries which have grown up in reliance upon the use of electric power imported from Canada, and as well the interests of the Canadian electric producing companies themselves, have become fixed and subject only to such changes as will protect the great commercial and industrial interests and rights now served by electric power brought from Canada; and particularly so as in these cases it appears that the percentage of export power to plant capacity is the same as has been and is allowed by Canada to other exporting electrical companies."

The Burton Act empowered the issuance of revocable permits for the transmission of additional electric power from Canada into the United States, and it may further be emphasized that the Fluid Exportation Act provides that licenses for the export of power from Canada are also revocable. What then is the real import of this remarkable statement by the Public Service Commission of the State of New York? It, in effect, proclaims that they, in New York, need not be concerned about permits and licenses, revocable or otherwise; it states plainly that if they can get this electric energy from Canada into the United States, and have it distributed so that their citizens and industries become dependent upon it, then Canada could not hope to alter these conditions—for, in the words of the Commissioners, the conditions in the State would "have become fixed, and subject only to such changes as will protect the great commercial and industrial interests and rights now served by electric power brought from Canada—that is to say—as will protect "the great commercial and industrial interests and rights" in the United States.

Nothing Must Interfere With U. S. Commerce

Some years ago, when the relations of the United States with Canada were under discussion before the "Select Committee on Relations with Canada, of the United States Senate," Mr. Joseph Nimmo, Jr., addressed the Committee with respect to the possibility of Canada dealing with her transportation facilities in a manner such as, adversely, to affect interests in the United States using Canadian transportation, and stated that:

"In the entire range of our Canadian relationship, from Halifax to Vancouver, the United States holds an over-powering advantage over Canada, and at every point. The suspension of the transit trade would be of comparatively small disadvantage to the United States, whereas it would be utterly disastrous to Canada . . . . . It is high time for the people of this country to appreciate the fact that their National Government holds a preponderance of commercial power on this continent as absolute as the preponderance of its military power, and to demand that those who are charged with the affairs of government shall adopt such measures as shall prevent any interference by a foreign power with the course of the development of our domestic or foreign commerce."

Canada, in connection with the exportation of electricity, certainly does not desire to assist in the creating of any circumstances which would even tend to invite a possible carrying out of any such policy as it suggested by the language in the Opinion delivered by the Public Commission of the State of New York, or in the address, just quoted, as delivered at Washington before the Select Senate Committee on Relations with Canada.

Once it is recognized how diverse and powerful are the financial interests represented in these great Niagara developments, it will be perceived how absolutely necessary it is that a situation such as is outlined in the foregoing remarks, be carefully studied and dealt with by government measures in a manner that will fully conserve Canada's great interests in Niagara power.

Mr. H. H. Couzens, Gen. Manager Toronto Hydro-Electric System.

A few of our most prominent Canadians whose energies are specially devoted to the supply and distribution of electric energy to the public.

Mr. Julian C. Smith, Director and Hydraulic Engineer Cedars Rapids M. & P. Co.

Mr. H. G. Matthews, Gen. Manager Quebec R.L.H. & P. Co.

Mr. W. C. Hawkins, Gen. Manager, Dominion Power & Transmission Company

Mr George Kidd, Gen. Manager B.C. E.R. Co.

Mr. A. A. Dion, Gen. Superintendent Ottawa Electric Co.

Mr. R. F. Hayward, Gen. Manager, Western Canada Power Company.

Mr. J. G. Glassco, Gen. Manager Winnipeg Municipal System

Electrical Conditions in Sister Colonies

India, South Africa and Australia Well Advanced—Brief Description of a Big Plant in Tasmania

Of the colonies of Great Britain, Canada doubtless leads in the extent and number of her electrical developments, though India, South Africa and Australasia are well advanced in the science of both large unit generation and high tension transmission. One company in India, the Tata Hydro-electric Company, is operating an installed capacity of 40,000 kw. at 100,000 volts. In South Africa, where the prosecution of the mining industry has required the use of large quantities of power, electric developments are numerous, though in general not large. The Victoria Falls and Transvaal Power Company, Limited, has units up to 11,000 h.p. and transmits at voltages as high as 40,000, and the Rand Mines Power Supply Company, a subsidiary of the latter company, operates units up to 12,000 kw. and transmits at 80,000 volts.

It must not be thought that Australia is famous only for its fleet. During the past year, in the island of Tasmania, there has been under construction a pioneer high voltage plant, designed to operate at 88,000 volts. This will be the highest voltage to date anywhere in that Dominion.

Australia is also in the van of electric railway development. As an example of this we may mention that the Victorian Government in 1912 decided to electrify the extensive system of suburban railways in Melbourne. After considering the advice of their consulting engineers, Messrs. Merz and McLellan, of London, it was decided to adopt direct current. A 1500-volt multiple unit system with overhead supply is now being installed. The length of the line to be electrified is about 150 miles, and the total length of single track is 290 miles, not including sidings, which total about 35 miles. One of the most important features in connection with this work is the engineers' decision to adopt rotary

Power House Buildings, Tasmania—Steel frame and covering.

converters throughout. These are of the Siemens type and comprise 11 of 2,000 kw. capacity, 16 of 1,000 capacity, and 4 of 5,000 capacity. The same company are supplying the transformers. The main distribution system operates at 20,000 volts, 25 cycle.

Through the kindness of Mr. J. W. Fraser, who in the earlier stages of the work left Canada to become engineer-in-charge of construction for the Hydro-electric Power and Metallurgical Company of Tasmania, and was later appointed general manager, we are able to give below a brief description of this plant. Mr. Fraser's connection with this company will be of interest to his friends in Canada, where he is well known. He was appointed by the British Westinghouse Company as their engineer-in-charge, and as the result of certain readjustments was, on the advice of the trustees of the debenture holders of the development company, retained as manager of the whole system. Recently

Tasmania Hydro Developments—Wood pipe line.

negotiations were entered into with the local government resulting in the purchase and prosecution of this work as a government enterprise, and Mr. Fraser some months ago found himself free to return to America. Mr. Fraser is a fellow of the American Institute of Electrical Engineers and a member of the Canadian Society of Civil Engineers.

The conditions surrounding the development work in connection with this plant appear to have been almost ideal from an engineering point of view,—small dam, short canal, natural storage lagoon, short pipe line. On the other hand, nearly all machinery had to be brought a great distance,—from England and America; even part of the cement from England. Taken altogether the favorable conditions of the site may be said to have been practically offset by the difficulties and expensiveness of transportation and construction.

The primary object of the promoters was to develop this power for metallurgical operations, and particularly to reduce zinc concentrates that formerly had been sent to German refineries; also to manufacture carbide now imported from abroad. In the immediate vicinity of this new plant, there is comparatively little manufacturing, so that the present market, aside from that mentioned above, will be lighting and small motor and street car loads. It is confidently expected that a considerable revival in manufacture will result from the development of cheap electric power in Tasmania. Among other things it is hoped that more of the English woollen manufacturers will be induced to locate close to the source of supply, for, as is well known, there are fifty per cent. more sheep in Australasia than in the United States, and the climate of Tasmania is unex-

celled for spinning. The following brief data regarding this plant will be of interest.

Short Description of Hydro-electric Power and Metallurgical Company's Plant in Tasmania

The accompanying illustrations show a part of the work that has been done on the development of the Great Lake hydro-electric scheme in Tasmania by the Hydro-electric Power and Metallurgical Company, Limited. Great Lake is situated almost in the centre of the island and a high voltage transmission line could easily supply power to any part of the island which is about equal in area to New Brunswick. The lake has an area of 42 square miles, is at an elevation of 3,350 feet above sea level, and is the greatest source of water power in the Commonwealth of Australia. The Shannon River, which drains the Great Lake, has comparatively little drop over the first six miles, but by diverting the flow at this point to the valley of the Ouse, a head of 1,150 feet is obtainable. The power company arranged to do this by a canal 3½ miles in length, a wood stave pipe one mile in length, and two steel pipe lines about three-quarters of a mile in length.

The canal varies from 25 ft. to 75 ft. in width, according to the contour of the land, and varies in depth from 5 ft. to 16 ft. At present it is being constructed for 20,000 h.p., but it can be increased in capacity whenever it is found desirable to increase the output of the power plant. The construction of this canal has been an expensive piece of work, on account of the fact that a considerable portion of it has been built through solid rock and a formation of clay and boulders.

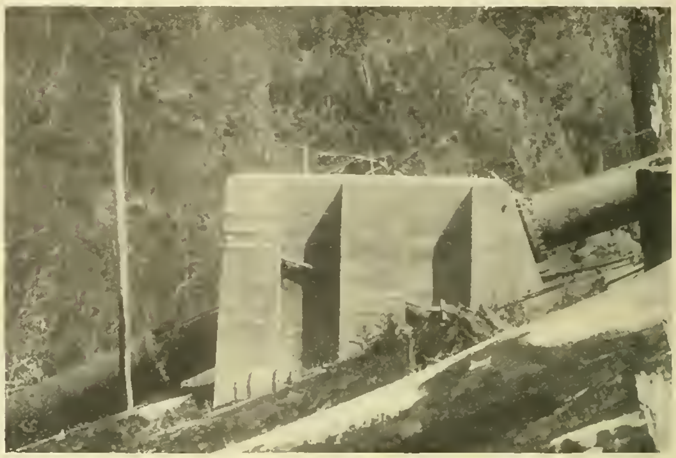
Between the end of the canal and the beginning of the wood pipe line a natural depression is being converted into a storage lagoon by the building of a dam about 5 ft. in

Steel pipe lines, ¾ mile long—Tasmania.

height. This lagoon will store enough water to develop 20,000 h.p. for a period of forty-eight hours. The dam as now constructed at the Great Lake will conserve sufficient water to give 40,000 h.p., which the Great Lake is capable of supplying, and by bringing the Ouse River into the lake and increasing the height of dam a few feet, this amount can be approximately doubled.

As can be seen from the illustrations, the cost of constructing the steel pipe line has been fairly expensive. The cost of clearing and forming the profile amounted to a considerable item by itself. A steel track had to be built over the entire distance, and a haulage installed for conveying the pipes up the hill. The sand used in the concrete work had to be washed out of the river bed and hauled for a considerable distance, and the concrete had to be mixed at the foot of the hill for half of the foundations.

The transport of cement and other material was also a large item in the construction costs of the undertaking. All material used near the power house had to be transported



Completed pipe anchor, one of fifteen, Tasmania.

from the terminus of the railway at Apsley to the site of the power house, a distance of 37 miles. The carting on the first 20 miles was done by horses, motor lorries, and traction engines on the Great Lake road, but the company had to build a wood tramline over a rough country for the remainder of the way. The part of the material used at the dam had to be hauled over fifty miles by road from railway terminus. In addition to wood and steel tramlines the company had to construct many roads in the vicinity of the works, some of which were very expensive and difficult to build on account of the mountainous and rocky country.

The power house buildings are of steel frame construction, with heavy galvanized steel covering. The present buildings are constructed for three 4,050 kv.a., 6,600 volt generators, with the necessary turbines, switch gear, and transformers, etc. The foundations for this building are very massive, due to the fact that the ground here has been deposited by the river and it was necessary to go down a great depth to obtain a solid footing. The transmission line to Hobart will be about 63 miles in length; the towers will be of galvanized steel type, built for two 88,000 volt lines, similar to a number of transmission lines that are now in service in America. This line will convey the power to Hobart, where a step-down transformer station has been erected, of similar construction to the buildings for the power house.

The hydro-electric portion of the company's interests have recently been purchased by the Government of Tasmania.

The following telephone systems are contemplated and have been authorized by the Provincial Government to raise the sums set opposite their names. The Willsmer Rural Telephone Company, Simpson, Sask., $2,700; the Paswegin Rural Telephone Company, Paswegin, Sask.; the Success Rural Telephone Company, Birmingham, Sask., $5,800; the Lewiswyn Rural Telephone Company, Raymore, Sask., $10,500; the Walpole Rural Telephone Company, Walpole, Sask., $10,500; the Cando Rural Telephone Company, Hitchcock, Sask., $4,500.

The Dealer and Contractor

Getting the Light You Pay For

Some Factors Influencing the Efficiencies of Semi-Indirect Lighting

By Mr. S. G. Hibben*

It is interesting to note some of the factors, chiefly those extraneous to the lighting unit itself, which enter into, and influence, the efficiency of typical lighting fixtures of the semi-indirect type. It is also of interest to know the relations between different classes of glassware, or the comparative results that may be obtained through the use of one glass bowl, or another. These facts "mean money" to the consumer. Knowing them forms the knowledge that enables him to use the right glass for his particular service conditions, and that aids him in placing the bowl at the best height, and surrounding it by the properly colored wall and ceiling surfaces, in order to get full value of the light for which he pays.

Semi-indirect lighting installations are deservedly growing more popular, and on the whole they are giving good service. However, some reasonable amount of care must be used to secure the best results, and even though this form of fixture may often supply a good quality and amount of illumination even when not properly installed, yet the point is this—if the semi-indirect lighting results may be improved by a common-sense consideration of the factors that influence these results, and by the application of a little simple kind of illuminating engineering, then by all means such improvements should be made, particularly when little or no expense is involved.

Suppose for example we consider two rooms, similar in all respects except that one is finished on the interior with green colored walls and ceiling, and the other is finished in light yellow. In each room identical light-density semi-indirect glass bowls are used (of the alba glass type) and the lamps are of the same size and candle-power. In the green room the illumination directly beneath the fixture (room approximately 20 feet square, ten foot ceiling, 100 watt tungsten lamp) will be 2.6 horizontal foot-candles at desk height, see Fig. 1. In the yellow room the illumination will be 3.4 foot-candles. Very nearly this same difference in illumination appears at other places in these rooms, other than directly beneath the fixtures, although the percentage difference in illumination increases towards the edges of the rooms.

In short, the use of merely a light colored interior finish instead of a medium green finish increases the light values beneath the fixture 30 per cent., and around the edges of the room increases it at least 50 per cent.

The curves of Fig. 1 and the other figures, represent the illumination as it would be along a line extending across the room and passing directly beneath the one centrally located ceiling fixture.

Referring to the same figure, it may be seen what effect the use of a heavy density (pressed opal) glass bowl of the same size and shape, but of different glass only, has on the lighting results. In the first place, the light that is diffused directly downward through the bowl is much less in the case of the dense glass, and the illumination directly beneath the fixture is correspondingly less. On the other hand, the amount of light that is reflected upward from the dense glass bowl is greater than from the light density bowl, and in the yellow room, where this upward light is re-directed towards the floor by the ceiling, the illumination values at distant points, or around the room edges, is slightly greater.

In the second place we may see how greatly the illumination is reduced when this heavy density bowl is used in the green room. The values are but little better than one-half of those found in the yellow room. Naturally the heavy density bowl depends more on the room interior, and especially on the ceiling, for its results, and the detrimental effects of a low efficiency (poorly reflecting) ceiling surface is very pronounced when this dense glass is used.

From this first example we would gather in general that as regards table top illumination, more depends on the quality of glass in the semi-indirect bowls than might at first be thought possible. We also see how large an effect the changes in color of an interior may have on the illumination

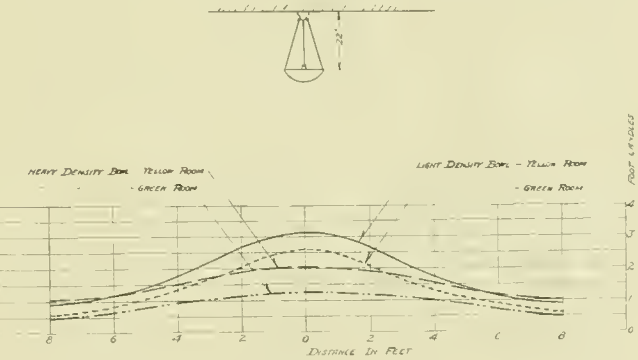


Fig. 1.

(bear in mind these are average and not extreme cases) and we realize how much more is the reduction caused by a dark ceiling in the case of heavy density glass than in the case of the light density glass.

Another factor influencing the efficiencies of semi-indirect fixtures is the hanging height of the bowls. Consider first the room with the yellow interior coloring, Fig. 2, and note the effects of changing the positions of the bowl, all other conditions remaining the same. Hung 32 inches from a 10-foot ceiling, the light-density bowl gives high values, chiefly in the near neighborhood of directly beneath the unit. Raising this bowl 10 inches or to the position 22 inches from ceiling, reduces the "hump" in the illumination beneath the fixture, as the curves indicate.

But note carefully what happens in the case of the heavy-density bowl. One might think off-hand that lowering the bowl would increase the illumination directly beneath the fixture as in the case of the light-density bowl, but this does not necessarily,—not usually, happen. Where the amount of downward transmitted light through the bowl is less than about one-third or one-fourth of the total light that the lamp is giving, and where the ceiling is a good diffuser or reflector

* Chief of Illumination Dept. MacBelk Evans Co.

of light, it follows that the majority of table-top illumination comes from the bright ceiling as the apparent light source. Hence any position of bowl that directs the upward reflected light so as to strike the ceiling at the best angles and over the right area, will be that position giving the highest values of illumination at the table-top level.

If, as in this example (Fig. 2) the low position of bowl

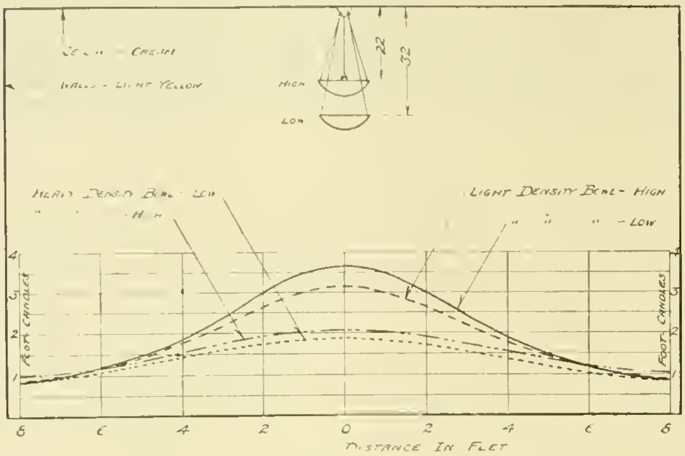


Fig. 2.

allows some light to be in a sense wasted at the edges of the ceiling surface, or on the upper walls, then this will be an inefficient position for best working plane lighting.

In Fig. 3, representing the same two bowls as of the previous test, but now placed in the green colored room, it is seen that low and high positions of the light-density bowl have even greater effects on the illumination beneath the unit, than in the case of the same bowl in the yellow room. The heavy-density bowl, as might be expected, gives very much less light in the green room since the ceiling surface is a comparatively poor reflector of light, and since this dense bowl depends so very largely on the ceiling-reflected light.

In this green room the dense bowl, either high or low, gives practically the same illumination. Of course there is a small amount of transmitted light that tends to raise the table-top illumination as the dense bowl is lowered, but at the same time the indirect component, or the ceiling light, is being reduced as the bowl is lowered.

It happens in this case—and might easily happen in quite a number of cases—that these opposing actions balance each other.

The results of different bowl positions, as shown in Figs.

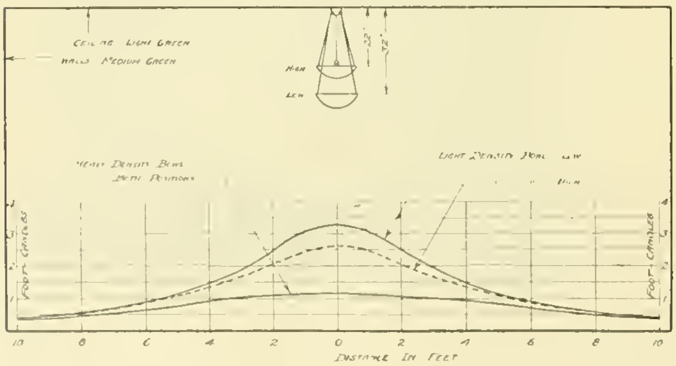


Fig. 3.

2 and 3, are typical of such office rooms, and residence libraries or dining rooms, where one centrally placed fixture is used. Quite often the emphasis in illumination is desired on the desk or table beneath the fixture, and the values at the room edges, even though one-third or one-fourth of the maximum illumination, are yet sufficient. Where it is desirable to have all the light possible on the working plane, and in the region closely beneath the fixture, then the light-density glass bowl should be hung low, but not to the extreme where the fixture appears unsightly on account of being out of proportion.

Where a number of units are installed to illuminate an extensive area, the hanging height and spacing should be considered simultaneously, in order to arrive at uniformity of illumination.

If we are interested in the comparison between various bowls, and in the average difference between direct and semi-indirect lighting, we can gain a good idea from the results as shown in Fig. 4. These curves represent the distribution in the same yellow room as has been mentioned above, but when using a 200 watt type "C" gas-filled lamp.

An intensive type of diffusing shade gives highest values at table height over the circle that measures about 16 feet in diameter. Next in efficiency come two light-density white glass bowls, Nos. 3,678 and 3,795. The blown opal bowl No. 3,843 is least efficient, except at the room edges.

It appears that different shapes of bowls, as the Nos. 3,678 and 3,795, even though of the same glass, may differ considerably in their action. The lamp position has a great deal to do with the action of any particular shape of bowl, and the size and placing of the lamps should be considered for each different style of bowl.

Sometimes the brilliancy of the light source is to be kept as low as is feasible, which would suggest the use of a dense glass bowl. But note that such glass reduces the illumination certainly at least one-third, even under the most favorable

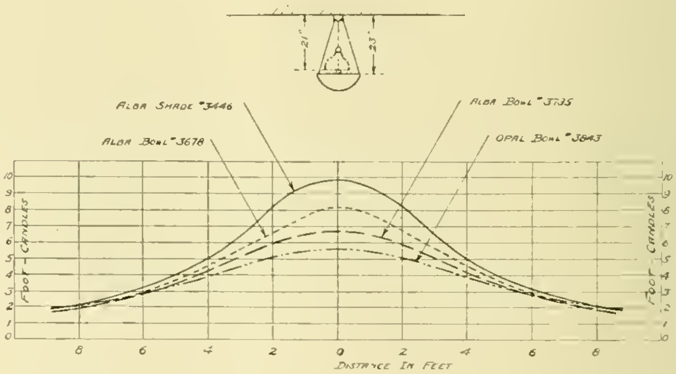


Fig. 4.

conditions of light ceiling. A better way of lowering the intrinsic brilliancy would be to use a light-density glass and select a somewhat larger size of bowl. Naturally with the larger area of bowl, the brightness per unit area of bowl will decrease.

The larger bowl will cost more at first, but stop and consider what a small part of the lighting expense this first cost of glass amounts to. Suppose we consider a room where one 200 watt lamp is used. Say this lamp is burned an average of 2 or 3 hours each day, or 1,000 hours each year. This will also be the average life of the lamp, so we can say that the lamp renewal cost is that of a new lamp each year, or $3.00 (list price of a 200 watt.)

The amount of power used is 200 watts for 1,000 hours each year, or 200,000 watt-hours, equivalent to 200 kilo-watt hours. This will cost, at the average rate of 5c. per kilo-watt hour, $10.00 per year. The total yearly operating expense therefore becomes $13.00.

Now say we were considering two bowls, one being an 18-inch diameter light-density alba bowl costing $6.00; the other a 14-inch heavy-density opal bowl costing $2.00. The ratios of the light-giving areas are about as 81 to 49—nearly the same as the ratio of the amounts of downward transmitted light, so that the intrinsic brilliancies of bowls are equal. Now with the light-density bowl we secure a certain

amount of average illumination which is that which we require, and for which we pay $13.00 yearly. With the dense bowl we secure two-thirds this amount, not sufficient—and hence we need a larger lamp, the 300 watt size if we wish to get the same amount of usable light as before. But the 300 watt lamp costs us $4.00 each year, and the current each year now amounts to $15.00. The annual operating cost becomes $19.00. On the first cost of bowl we save $4.00 by the purchase of cheap glass. In order to get the same amount of light as we would have secured had we purchased a better grade of glass, we each year pay $6.00 more for lamps and current than we otherwise would need to do. Where is the economy of the low first-cost unit?

The illuminating engineer quite frequently finds that the ultimate expense of a lighting installation is overlooked by the consumer. Of course there are any number of cases where foot-candles of illumination do not form the sole consideration; where colors, decorations, and effects are wanted, so that other glasses rather than those that give highest quantity of light, are justifiable. Nevertheless this question of ultimate efficiency, or better, quantitative efficiency, is pertinent.

So finally we can, from these examples, better appreciate the influence that kinds and shapes of glassware, hanging heights, and interior colorings have upon the quantity of usable illumination. If we are to get all the light we pay for, we certainly must take into consideration these important factors.

A Full Time for Canadian Factories

By H. N. Howlett*

The "Buy within the Empire" slogan, brought into more prominent notice by the trend of recent events, is not a new one; it has always been with us, more or less, but by reason of apathy and indifference on the part of the purchasing public the question has been allowed to drift to the extent that it practically ceased to be a factor in business at all, as far as Canada is concerned.

From the business point of view this result has the appearance of being due to inactivity on the part of the Canadian manufacturers concerned, or, perhaps, imperfect organization is the better expression to use, and the public can hardly be blamed for the shortcomings of the manufacturer in demonstrating the advantages of his products.

The general public needs to be educated in a practical and common-sense way to distinguish between what habit has taught them to consider as good because it is "foreign made," as compared with the domestic product.

With articles of a semi-technical nature, such as electrical supplies, in which our interests lie, personal view and demonstration are likely to have a much more lasting effect than any other method. The most practical way to reach the public would seem to be, therefore, the equipment and permanent maintenance of local public showrooms, the expenses of which could be apportioned amongst various local manufacturers and others interested, with possible municipal assistance, the maintenance expenses thus being kept down to the lowest limit consistent with practical results.

As far as electrical supplies for use in the home are concerned, the variety of articles is necessarily limited to those coming under the actual use and observation of the consumer, such as lamps, fixtures, irons, toasters, hair-dressing conveniences, cooking and heating apparatus, house-cleaning appliances, fans, etc., so that a comprehensive, attractive, and educational range of exhibits in local centres should not be difficult to bring about by means of carefully-considered co-operation.

Co-operation is the keynote of success, and as from the manufacturer down to the contractor all are dependent for sales on the general public, obviously, therefore, it is the duty of all interested sections of the trade to get together with a view to bringing about the "public educational" propaganda outlined above, on a practical business-like basis.

In seeking to deal with the public, technical or semi-technical articles, price lists, illustrated catalogues, attractive booklets and like productions are not convincing, and their effect is therefore but transitory; the permanent effect is best obtainable by personal demonstration and proof that the advantages claimed for Canadian manufacturers are sound. The whole question is this—as a nation we have been importing unnecessarily largely, and, presumably, with satisfaction, and before the buying public can be expected to change their preference for "foreign" merchandise in favor of similar goods produced in Canada, they must be assured for themselves that they are going to get at least equal quality at approximately the same prices that they have hitherto enjoyed—once convinced of this the rest is a matter of following up the advantage gained to the full with energy and perseverance.

In this country, with our wonderful range of raw materials, and our favorable geographical position, we should unquestionably develop into the largest manufacturing overseas dominion in the British Empire, given the necessary whole-hearted and energetic co-operation amongst producers to reach and convince the public that they have nothing to lose and everything to gain by individual support of the merchandise turned out in Canadian factories.

It must not be overlooked that when European affairs once again resume their comparatively normal state the existing prejudice against the nations at present at war against the allies will lessen, and extraordinary efforts on their part will be made to attempt to regain the lost hold on their colonial trade, so that now is eminently the time for our strongest efforts, which must be sustained indefinitely so that our hold on our own markets will be so strong and secure that we can confidently and successfully meet the exceptional competition that sooner or later we shall assuredly have to face.

* Secretary-Treasurer, Perkins Electric Co., Montreal.

Guaranteeing Electric Work

We note from a short article in "Electrical Industries" that the electrical contractors in the Mother Country are wrestling with much the same kind of problems as are our home contractors. However, they are approaching the matter from rather a different viewpoint. The electrical contractors of Canada have practically no organization, and little more than individual influence can be brought to bear on such matters. However, at certain points progress is being made, and, thanks to the activity of some of our inspectors, rules have been formulated which admit of a certain amount of control over electrical work. The tendency in Ontario is to throw the responsibility on the government and to get them to legislate in the matter.

In England, as noted, the matter is being approached differently. The electrical association as a body has agreed to guarantee the workmanship and material of all its members. After a certain date, every member of this association is pledged to a certain standard of installation work and will have behind him the financial guarantee of his fellow members that work entrusted to him will be carried out in such a manner as to be satisfactory to all concerned.

There is little comfort to be taken from the action of this contractors' association except that it is a recognition that the difficulties under which we labor in Canada are not peculiar to our Dominion. The guarantee of any electrical contractors' association may mean much or little, depending on the care with which members of this association are

chosen and on whether, by using care in the choice of members, they are able to include practically all the contractors in any particular locality. For example, in the case of Toronto, there may be (nobody knows) 400 or 500 electrical contractors, yet the membership of the Toronto Electrical Contractors' Association is probably less than twenty. It is evident that the guarantee of the Toronto Electrical Contractors' Association of the work of each of its members would not get to the bottom of the trouble in Toronto, and, indeed, would not mean anything at all to the consumer, as in this particular case the association consists of firms whose individual reputations are in themselves sufficient guarantee that the work they undertake will be properly executed. It is not the type of man who will join the association and who is willing and able to guarantee his work that is to be feared. We believe that the agitation at present under way in Canadian electrical contractors' circles, and which the Electrical News has given as much publicity as possible to from time to time, is the correct solution and the only one. Each contractor must be capable before he can install work that will be satisfactory. The only guarantee of capability is that he must satisfy some recognized authority that he is capable. The recognized authority must be responsible for the work accomplished. It appears to us that it would not only be futile in the attempt but quite impossible of accomplishment, to make any one electrical contractor even indirectly responsible for the work of any other.

License All Electrical Workers

The city of Ottawa has made considerable headway in the matter of controlling its electric wiring and auxiliary installations. Like every other city, Ottawa had an army of inferior workmen who were constantly interfering with up-to-date installations and installing inferior work. We are advised, however, by Mr. Norman E. Bell, chief electrical inspector of the city of Ottawa, that, with the inauguration of a licensing system for all electrical workers, this difficulty has been overcome, and the licensing has afforded a splendid protection to the reliable contractor.

Electrical workers, to obtain their permit, are required to try written examinations, the papers being graded as follows: (1) motors and other electrical devices; (2) conduit installations; (3) knob and tube, fixture hanging and repair work. The police are strictly enforcing the by-law. In addition to the license, electrical workers are required to submit proper plans and specifications for large electrical installations before a permit is granted for installing the work. Mr. Bell adds that "with the splendid co-operation which has been given us by the supply companies, together with the support of the reliable contractors and the strict enforcement of the hydro regulations, we have obtained throughout the city a standard of wiring."

The fee for a license for an electrical worker has been fixed at one dollar. The by-law which deals with this matter contains the two following interesting paragraphs:

"'Electrical worker' shall mean and include any person engaged or occupied in or undertaking to do the actual work of placing, installing or altering electric wiring or other apparatus to which electricity is applied.

"No license shall be issued to an electrical worker until and unless he shall have filed with the Chief Constable a certificate from the Electrical Inspector of the city of Ottawa, to the effect that he has passed such examination as such Inspector thinks necessary, and that in the opinion of such Inspector he is competent to act as an electrical worker."

G. M. Gest, Limited

Among the incorporations of note since the beginning of the year may be mentioned that of G. M. Gest, Limited, engineers and contractors, with their head office in the Power Building, Montreal, and branch offices in Winnipeg and Vancouver. For the past decade this company has been identified with all the large Canadian underground conduit installations from Quebec to Vancouver, and has also made a specialty of installing ornamental lighting systems and high tension pole lines. At the present time they are engaged in the installation of the conduit system for the Electrical Commission of the city of Montreal, having constructed all the work to date for that Commission, and are now completing the down-town district on Craig, Notre Dame, St. James, and connecting streets. On all work executed by this company all the latest machines for making installations as rapidly as possible are used, thereby inconveniencing the public as little as possible. It has always been Mr. Gest's motto to "Please the Public."

In addition to this installation for the city of Montreal, among the other systems installed which are each over one million duct feet, may be mentioned that of the Power Department of the City of Winnipeg, Montreal Light, Heat & Power Company, and the Hamilton Hydro-electric Commission. In addition they have installed conduit systems for the Hydro-electric Power Commission of Ontario at Niagara, for the Toronto Hydro-electric System, Toronto Street Railway, the Dorchester Electric Company at Quebec, the Town of Outremont, the Ottawa Electric Company, the Great North-Western Telegraph Company at Ottawa, the Winnipeg Electric Railway, the Transcontinental Railway at Transcona, the Western Canada Power Company, the British Columbia Telephone Company, and British Columbia Electric Railway Company, at Vancouver. For the Bell Telephone Company of Canada they have installed conduit in Outremont, Verdun and Longue Point. They have installed ornamental lighting systems for the city of Quebec, Town of Outremont, and the City of Winnipeg.

At the last convention of the Canadian Electrical Association held in Montreal there were few of the electrical fraternity who did not visit the "Tomb of the Wire," where Mr. Gest had covered one of the city transformer manholes with an illuminated dome, and fitted the interior with draperies, offering special inducements by way of music and refreshments for the weary delegates to linger and become better acquainted.

To those who will attend the meetings of the electrical associations at the Pan-American Exposition in San Francisco, Mr. Gest extends a cordial invitation to visit his exhibit where he will have on display all types of underground distribution both solid and draw-in. Manholes, types of conduit material, transformers, junction boxes, switching devices, cable, in fact everything pertaining to underground conduit construction, will be on exhibition at his booth, and for those who are unacquainted with this type of construction it will be an excellent opportunity to see what is the very latest in this work.

Large Electric Oven

The Hughes Electric Heating Company have installed in the Lawrence Bakery, Toronto, an electric oven with capacity for 270 loaves. On a recent test ten batches of this amount were turned out in eight hours. Mr. Lawrence is highly pleased with his new equipment and has decided to install an oven of double this capacity. The Hughes Company are commencing the manufacture of stoves in Toronto about March 15, and for this purpose have taken factory space and show rooms at 585-595 Yonge Street.

Fire Protection Amendments

The electrical committee of the National Fire Protection Association have issued a bulletin containing certain recommendations, which will be considered at the meeting of the committee to be held on March 24th and 25th, at the New York Board of Fire Underwriters, 123 William Street, New York City. The reports refer to such matters as were brought to the attention of the committee at the last meeting, and which were considered of sufficient importance to require further consideration before action was taken. These changes will be carefully considered by the electrical committee at a preliminary meeting, and when brought before the general meeting, the recommendation of the electrical committee as to their adoption or rejection will be stated. It has been the endeavor of the committee to make only such changes in the code as are made necessary by progress in the electrical art, or such as have been shown by experience to be necessary to safeguard against hazard. This course, doubtless, meets with the approval of electric lighting and contracting interests, as changes in the code, however slight, cause more or less confusion and trouble.

Getting at the Seat of the Trouble

The following letter is one of a number received by Mr. Geo. J. Beattie in reply to his open letter in the Electrical News of January 15th, dealing with the status of the electrical contractor in Canada. We have been asked to give this letter publicity and have pleasure in doing so, as it undoubtedly gets at the heart of things. It is only by speaking plainly of the difficulties in our way that we can hope to remove them. We have had a number of splendid letters dealing with this subject recently, and trust that our readers will not hesitate to show the interest we know they actually feel in this important matter. If every reliable electrical contractor will consider this business his own, we shall soon do something to improve conditions and, as Mr. Marchand says, make the electrical contracting business a fair paying proposition.

Ottawa, February 11, 1915.

Mr. Geo. J. Beattie, Esq.,

72 Victoria Street, Toronto, Ont.

Dear Sir:—

I have read your article in the Electrical News, and have also received your letter of January 14th. I have also received a letter from the Hydro-electric Power Commission along somewhat the same lines. As you are well aware, the Hydro-electric has very wide powers as it is. If we give them more are we assured that they will not overstep what we consider our aim? I believe the proposal to tax the electrical contractor carrying on business, is a good one. The architects should be made to submit a detailed plan and a clear specification of each job to the inspector before calling for tenders. In the city of Ottawa all electrical workers are licensed, and they are subject to a fine of $50.00 if caught working without having been licensed. This by-law was put in force on the first of the year 1915.

The greatest trouble here is the cutting of prices by the basket men, who are legion. These men are satisfied to make wages on their work. They allow nothing for overheads, employ no labor. We used to sell a few of these contractors material at an advance of 30 to 40 per cent. over our cost, and this helped to even up matters. Unfortunately, now all the wholesale houses are selling these men at the same prices as they sell to us, giving us no protection whatever. This is utterly wrong in every way and should be remedied at once.

The situation is like this. Take the case of Ottawa. There are only three electrical houses doing general contracting and general wholesale and retail business, and carrying a considerable stock. I have never seen a week that we did not have five or six travellers from wholesale houses, manufacturers, etc. It is impossible to buy from everybody. Therefore, the one who gets left, gets mad and sells to every Tom, Dick, and Harry he can, at prices ridiculously low.

Now, I believe that this Canadian Association should join hands all through Canada, to stop this kind of thing, by making the jobbers give us reasonable protection over the basket contractor, who does not have any overhead expense.

It is time the electrical business should be made a paying proposition. The saying that the electrical business is the business of the future, etc., is all rot, and we have a lot of good hard work to do before we can make out of it a fair paying proposition.

I am sending this letter to you, and leave you at liberty to publish it or not, as you will think best. I wish you success and will give you any help I can.

Yours truly,

Marchand & Donnelly,

Per P. C. Marchand.

Commercial Electrics, Limited, has been incorporated; capital, $500,000; head office, Toronto.

Trade Publications

Trolley Retriever—folder issued by the Ohio Brass Company, Mansfield, Ohio, describing the O.B. trolley catcher

Stock List—by the Crouse-Hinds Company of Canada, Limited, Toronto, showing the complete list of materials and parts that can be shipped immediately by this company on receipt of order.

Engineering Equipment—The Electrical Engineering Equipment Company have just issued bulletin No. 104, covering baseboard clamps, table racks, floor air boxes, insulating compounds, malleable pipe and switchboard fittings.

Electrical Fans—Booklet issued by the Robbins & Myers Company, Springfield, Ohio, describing their "Standard" fans for d.c. and a.c. currents. Desk and oscillating fans can be used interchangeably on either desk or wall bracket position.

Guy Anchors—The Electric Service Supplies Company have issued an attractive folder listing, describing and illustrating the Never-Creep anchor, for which this company is pushing the sale. Some claims made for this new anchor are that they will not creep because the entire pull is made against undisturbed earth, that they are easy to install and that their cost is lower than any other anchor on the market. In this folder the illustrations compare the effectiveness of the different anchors now most popular with that of the "Never-Creep."

Westinghouse Publications—Leaflet 3751, describing with illustrations current limiting reactance coils; folder 4226, explaining in a popular way how electric power helps manufacturers; folder 4204, entitled "For better projection," describing the Westinghouse Cooper-Hewitt rectifiers for moving picture service; folder 4152-A, entitled "The small motor that makes sewing such easy work"; folder 4266-A, the electrical breakfast set; section DS-300, covering the entire line of Westinghouse fans for the year 1915; Westinghouse railway data exchange, January, 1915; leaflet No. 3698-A, describing motors for linotype and intertype machines; leaflet No. 3770, describing cam limit switches; "Small Motors, No. 32; folder 4201, "The A B C of Automobile Battery Charging"; leaflet No. 3679, on electric vehicle battery charging.

The Development of the Ferranti Electrical Co. of Canada, Limited

By W. A. Coates, A. M. I. E. E.

The first practical electricity meter was designed and made in England by Mr. S. Z. de Ferranti, and it was therefore peculiarly appropriate that the Ferranti meter should also be the first British-made instrument to appear on the Canadian market. In 1908 Mr. G. C. Royce took over the Ferranti Canadian agency, and very quickly brought the business up to handsome proportions.

In order to meet the requirements of Canadian customers, various features of the original meter were changed, finally resulting in the evolution of the present type "C" meter. This new instrument made so favorable an impression that the directors of Ferranti Limited decided to establish a separate company here, so as to give even better attention to the requirements of the market. This change was made some three years ago, Mr. Royce continuing as manager of the new company.

During the summer of 1913 the Ferranti Company commenced the manufacture of meters in Toronto, the requirements for various users being found so diverse as to render it difficult to carry an adequate stock. The factory was therefore established with a view to improving the service by carrying in stock all meter parts. In this way, any size or type of meter can be built up, tested and dispatched in twenty-four hours if necessary. So successful has this venture proved that all coils are wound, trains assembled and covers made on this side. In fact, only the magnets and those parts made with dies or to jigs, are now imported from the Manchester works.

The illustration, Fig. 1, will give a good idea of the layout of the meter shop, which occupies the whole of the second floor of the premises at 90 Sherbourne Street, Toronto. The testing arrangements are particularly noticeable. Accommodation is provided so that six groups of twenty meters each can be calibrated at one time. Meters are connected up by means of plugs, thus saving considerable time. A storage battery and a variable speed motor-alternator furnish either d.c. or a.c. at any frequency or voltage to the test benches.

Fig. 1– The meter shop.

A special glass cased instrument cabinet serves all the test benches. The standards employed are all of the indicating type, rotating standards not being deemed sufficiently reliable for all the year round service. The wattmeters are by Kelvin & White, all the other standard instruments being of the firm's own make.

The smaller loads are furnished by lamps, controlled by a very complete yet simple switching system. Heavier currents are obtained by means of transformers with variable tappings; the potential coils also are excited from a multirange transformer. All meters are tested on inductive load and are brought within 2 per cent. on 50 per cent. p.f. lag and lead. For this purpose an inductance coil with numerous taps is used.

The terminals, switches, plugs and rheostats for controlling the test loads are all brought to one panel, immediately adjacent to the instrument cabinet. This panel also controls the 2200 volt supply for flash test which is given to every meter before shipping.

Fig. 2—Ferranti switchboard rooms.

Within the last few months the Ferranti Company has also commenced building switchboards in Toronto. Conditions at present being unfavorable for extension on a large scale, they have so far confined their activities to comparatively small boards. The parent firm has a world-wide reputation in this direction, and is one of the leading British switchgear concerns.

The boards built on this side embody Ferranti instruments, switches and other detail apparatus which line up in all respects with Canadian requirements. All work, other than the manufacture of details, is being carried out in Toronto by men of wide experience, and it seems reasonable to expect that the Canadian house will soon achieve a reputation for switchboards equal to that of the parent company.

At the beginning of 1914 the Ferranti Electrical Company of Canada took over the agency for Messrs. Bruce Peebles & Company, of Edinburgh, Scotland, with whom they have very close relations. They are therefore now in a position to carry out complete plant schemes of practically any size.

Starting with an agency in a small way, this firm has developed as circumstances warranted, and is now established among our manufacturing concerns. It may be classed as typical of the young industries which are so valuable to Canada, and may fairly be considered on a par with the older established factories from the "Made in Canada" point of view.

The arbitration proceedings between the Peterborough Light and Power Company and the city of Peterborough are at present in progress. The engineer of the Hydro-electric Power Commission of Ontario has valued the plant at a replaceable value of $155,000. The present value of the plant is given as approximately $84,000.

What is New in Electrical Equipment

Nitrogen Street Lighting Fixtures

The problem of scientific White-Way street lighting has to be observed from different standpoints than other systems of lighting, such as factory, showroom or residential lighting, etc. It is practically the one class of lighting where one has to pay special consideration to weather conditions and properly deal with the cost of maintenance. These points are of special importance in this country where weather conditions are extreme, glassware comparatively high priced, labor high priced, and sometimes scarce, and the cost of electrical energy so reasonable.

White-Way street lighting systems always consist of a large number of units which vary from 100 to 500 c.p. This fact emphasizes the importance of a practical, simple and rugged lighting fixture which must be easily trimmed, glassware easily cleaned, and designed so that breakage of glassware is made a minimum. Ventilation must be sufficient and weather conditions must be reasonably met. This latter statement would make it seem as if the fixture designer had to go in two opposite directions at the same time, because what will provide against weather conditions in the majority of cases will obstruct ventilation.

Reg. Design A. H. Winter Joyner, Ltd., Toronto

Fig. 1

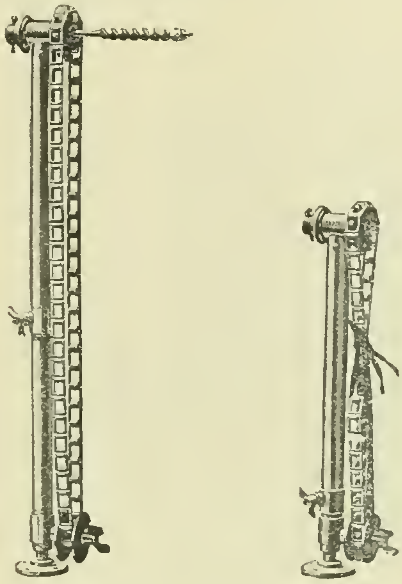
Patented

Fig. 2

Fig. 1 shows a fixture which combines in a high degree the necessary fixture qualities. It is properly ventilated at bottom and top and presents a very pleasing appearance. This figure also shows how the hood and lamp support is independent of glassware. Fig. 2 indicates how easily the glassware is cleaned and the lamp replaced. This particular fixture is the latest development in fixtures for nitrogen-filled lamps and the detachable feature has been carefully worked out by A. H. Winter Joyner, Limited, specialists in street lighting.

Collapsible Hand-Boring Machine

A light-weight hand-operated machine for boring holes for electric wires which can be collapsed from a working length of 28 in. to one of 18 in. so that it can be packed in a tool bag has recently been placed on the market by the Henderson Electric Company, Ampere, N.J. The device will bore holes at any angle, through studding, bridging, plates, floors and joists. The above company also makes a large machine similar in design to the collapsible machine, although it is only used for boring holes in overhead joists. All working parts of the two types are interchangeable. The larger machine stands on the floor, while the smaller one may be employed in a manner similar to that in which a breast drill is used. The collapsible machine weighs only 6 lb. Use is made of ball bearings, drop forgings and seamless tubing. The device is operated by pulling on a chain, causing the drill to revolve.



Boring machine collapses to 18 inches.

Hydro Rubber Gloves

The Sterling Rubber Company, Limited, of Guelph, Ont., manufacturers of hydro rubber gloves, state that their gloves have been adopted by the Hydro-electric Power Commission of Ontario and other large users, after exhaustive tests as to their resistant qualities compared with other makes, and quite regardless of price. In the manufacture of these gloves the company claim to have placed the factor of safety to the wearer above every other consideration. They have spared no expense in obtaining ingredients, using only the best and purest obtainable of fine para with only such ingredients added as are necessary to make the gloves tough and wear resisting. One of the most important features of these gloves is the reinforcement placed below the thumb, the point at which the strain is always the greatest. The Sterling Rubber Company have issued a very interesting little pamphlet describing these gloves.

Special Three-Way Bus Supports

The Electrical Engineers Equipment Company of Chicago have just recently supplied the H. M. Byllesby & Company with a large number of special three-way bus supports, illustrated herein. This material is to be used upon the system of the Minneapolis General Electric Company, which is one of the Byllesby Company's largest properties. The accompanying illustrations, Figs. 1 and 2, show a front and side view of this support and Fig. 3 shows how they are fitted into the bus structure. The support is designed to insulate 3 in. x 1 in. of rectangular bus bars for a working pressure of 17,000 volts. The buses are mounted in a vertical plane as shown in Fig. 3. The top and bottom supports are fastened to two parallel 1½-in. pipes, 90 deg. apart. The middle support is fastened to one 1½-in. pipe, bolted to and separated from the top and bottom supports by transite board. Each bus, therefore, is in a separate compartment. The chief advantages of this type of construction are low

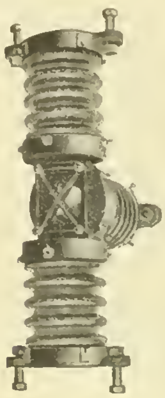


Fig. 1

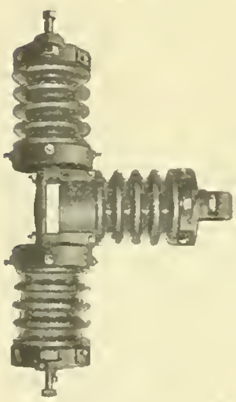


Fig. 2

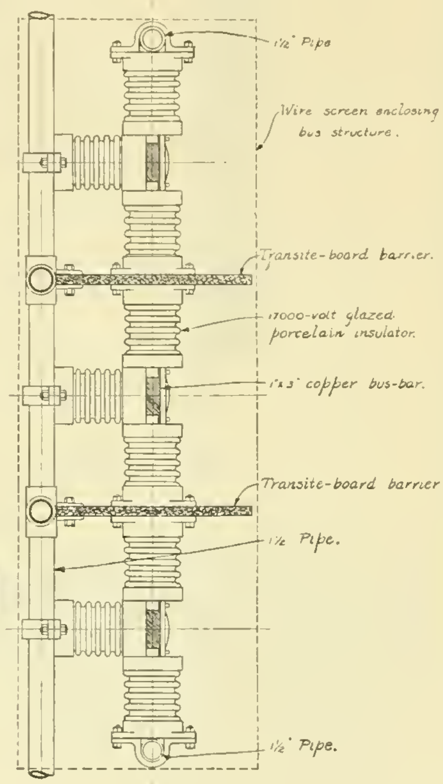


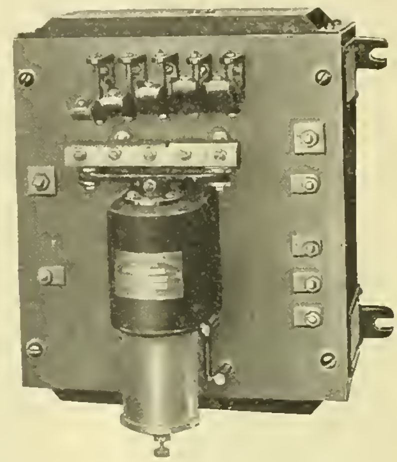
Fig. 3

first cost, ease of installation, accessibility to buses and cool operation of same. This arrangement does away with the building of costly concrete or brick bus structures. The bus-bars are accessible at all times, and owing to the open structure the undue heating of buses even at large overloads, is avoided. The three porcelain insulators were tested separately after the support was assembled. Each insulator was made to withstand a pressure of 60,000 volts before leaving the factory. These tests were made in the factory's testing laboratory. The outer clamps are of malleable iron, while those which support the current carrying parts are of composition metal. All clamps are adjustable throughout 360 degs. These supports were designed by the engineering department of the Electrical Engineers Equipment Company, working under the direct supervision of the engineers of H. M. Byllesby & Company. This is the second order for this type of support.

It is stated that the township council of Dore, Ont., will construct 3½ miles of telephone line.

New Line of Automatic Starters

The Industrial Controller Company, formerly the Independent Electric Manufacturing Company, has recently brought out a new line of automatic starters for direct current motors. The starter is very simple and rugged in design and consists essentially of a series of resiliently mounted contact fingers, a movable contact bar, a solenoid and dash-pot, all mounted on a slate base. The contact bar, solenoid core and dash-pot piston are all rigidly fastened together, forming a single movable part having a simple straight line motion in a vertical direction. The contact bar is moved upward by the solenoid to start the motor and when released drops quickly by gravity to the "off" position. The contacts are of the "butt" type, having a slight rubbing action when closing, which tends to keep the contact surfaces clean.



Automatic starter for d. c. motors.

Both finger tips and contact bar are removable and are so designed that in emergencies, new parts could be readily made by an ordinary mechanic from commercial sizes of copper and carbon. The solenoid is entirely enclosed in a cast iron frame, or housing, to the bottom of which is attached the dash-pot cylinder. This construction affords positive alignment between solenoid core and dash-pot, and renders the latter easily removable. The dash-pot is of the vacuum type with an adjustable air inlet valve which controls the time of acceleration. A portion of the vacuum chamber is provided with a by-pass thus permitting the contact bar to jump quickly to the first contact and eliminating the arcing that would otherwise occur. The acceleration can be varied over a wide range and the adjustments made if desired while the starter is in operation. The starters are designated as Type "E," and are suitable for a great variety of applications.

Jefferson Electric Manufacturing Co.

Mr. J. A. Bennan, treasurer and general manager of the Thordarson Electric Manufacturing Company since its incorporation, has recently severed his connection with that company and incorporated the Jefferson Electric Manufacturing Company, located at 847-851 West Harrison Street, Chicago. The new company will manufacture a complete line of bell ringing, toy, sign lighting and welding transformers, battery switches, steel battery box outfits, make and break and jump spark ignition coils, and a line of high tension transformers for testing, laboratory and research work.

Robbins & Myers Plant Additions

The Robbins & Myers Company, Springfield, O., have just completed a new addition to their plant. The new building is 363 by 83 ft., four storeys and basement. The building is of the best construction throughout, and will enable this company to manufacture and ship under the most ideal conditions.

Saskatchewan Telephones

The Department of Telephones of the Province of Saskatchewan have just issued their report for the financial year ending April 30th, 1914. The report shows that on that date, the total number of exchanges operated by the government was 96, and toll offices, 302. On the same date the number of long distance pole miles in operation was 3,388, and corresponding long distance wire miles, 13,714. Regarding new legislation respecting rural systems, the report contains the following interesting information:

"The year has seen the application of the terms of the legislation passed at the 1912-13 Session of the Legislature empowering farmers' telephone companies to raise by way of debenture sale the capital required to install rural service. The new legislation excited a great deal of interest and discussion and that part of our Department in charge of rural systems has had a very busy season giving interpretations to inquirers of the terms of the Act and the regulations and instructions handed out as covering action by companies forming or established. Local initiative is encouraged and is allowed to follow its bent under direction and the very hearty acceptance of the opportunity given to improve social and business interests stands out as an evidence of the capacity and inclination of our people for collective action where common end is to be attained. Only a comparatively small proportion of the companies incorporated succeeded in getting systems erected and operating. This was in large part due to the hesitation of financial houses to accept this new form of security—a rural telephone debenture—before subjecting it to closest scrutiny. This security would, however, seem to have made its way into their favor, and we may expect to see large blocks sold and much rural construction undertaken during the coming season."

Mr. Pasooe, Manager

The Coil Manufacturing and Repair Company, which recently purchased the plant of the Cleveland Coil & Manufacturing Company, has enlisted the services of Mr. R. P. Pascoe, formerly manager of the Cleveland Coil & Manufacturing Company. Mr. Pascoe is well known in this line of endeavor, as he was formerly connected with the Van Dorn & Dutton interests as superintendent of their electric department.

Electric Light by "Horse" Power

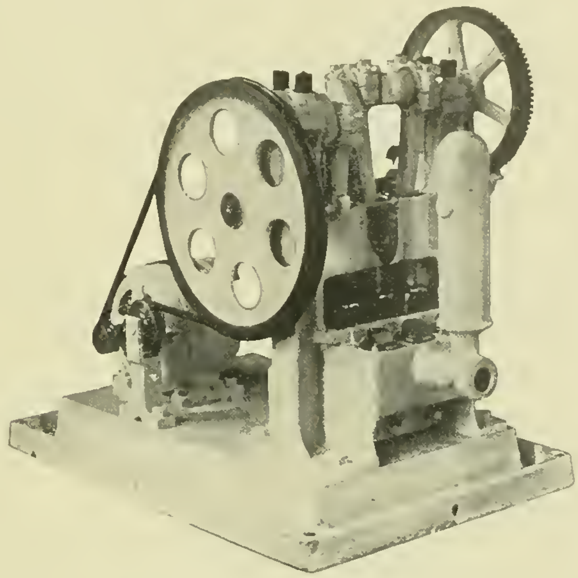
The Electric Horsepowers Company, 906 Elm Street, Cincinnati, Ohio, have developed a practical machine for the production of electric light and power in country homes or places where electric current is not obtainable from central

Capacity for 30 20-watt lamps.

station sources. This machine is illustrated herewith. With a storage battery supplementing the generator, it is claimed that the use of a horse five or six hours a week will furnish sufficient electric light and power to the ordinary home. The horse maintains a walking gait in a 14-ft. circle, at the rate of less than 2 miles per hour. If he slackens his speed, an electric bell rings as a warning, and immediately thereafter if the speed is not increased an electric whip strikes him on the back. The generator furnished with this machine supplies current at 40 volts. The capacity of the generator is 30 20-watt tungsten lamps. Where it is required to operate motors, as around farm buildings, this may be accomplished by operating the generator and the battery at the same time, in which case the capacity is sufficient for a 2 h.p. motor.

A Motor-Driven House Pump

The accompanying illustration shows a pump particularly adapted for use on the farm or country estate and in



⅛ h. p. motor driving house pump.

some manufacturing establishments. The outfit requires no attention or care except occasional lubrication. It can be located in an out of the way place and can be easily and safely controlled from a distant point by means of a simple switch. The pump is driven by an ⅛ h.p. Westinghouse motor, and will fill a 300-gallon tank located 120 feet above it in less than three hours, or, with a consumption of about .3 kw.h. The pump is of the triplex type with cylinders 1¼ x 2 inches; length is 21 inches; base 16 x 23 inches; manufactured by the Goulds Manufacturing Company, Seneca Falls, N.Y.

The British Aluminium Company, Limited, of London, England, are distributing, through their Toronto office, a limited number of booklets entitled, "Aluminium facts and figures." These booklets are of the loose-leaf type and handsomely bound in green cloth. The initial publication contains 56 pages of valuable aluminium information.

The Canadian Laco-Philips Company have announced the removal of their offices from Victoria Street to Room 1301 C. P. R. Building, Toronto, and request that all communications in future be addressed to the new office, Mr. C. C. Bothwell, manager.

Personals

Mr. H. C. Blackwell has been appointed engineer to G. M. Gest, Limited, Montreal, Winnipeg, and Vancouver, in succession to the late Mr. H. H. Stannard.

Mr. O. A. Jorgenson has been appointed manager of the Regina commercial office of the C. P. R. Telegraph System. Mr. Jorgenson was formerly in Winnipeg and later in Port Arthur as manager of the C. P. R. telegraphs at that point.

Current News and Notes

Aylmer, Ont.

A by-law will be submitted to the ratepayers in the near future, authorizing the guarantee of their share of the bonds of the proposed hydro radial line from Tillsonburg to London.

Berlin, Ont.

The profits of the Berlin and Waterloo Railway System for the past year amounted to some $400, which are divided between Berlin and Waterloo in the proportion of 3 to 1.

Collingwood, Ont.

The Collingwood Shipbuilding Company are installing motors in their plant, to be operated by power secured from the local water and light commission. To date 60,000 h.p. capacity has been put in, and it is anticipated that this amount will be largely increased from time to time.

Cochrane, Alta.

Negotiations are under way between the town of Cochrane and the Calgary Light & Power Company, looking to an agreement under which the company shall supply power for the operation of Cochrane's lighting and power requirements. At the present time a small local plant is operated, but it is believed that terms can be arranged with the larger company which will result in a considerable reduction in operating costs.

Estevan, Sask.

After conducting a municipal electric store for some time, the town of Estevan has decided to discontinue this practice. Local dealers are taking over the stock of the town and undertake to carry on the business of supply and contracting at reasonable figures.

Kingston, Ont.

It is reported that an agreement has finally been reached between J. M. Campbell, of the Gananoque Electric Power Company, and the city of Kingston, whereby the city obtains a very much needed addition to their power supply. The prices quoted appear to be exceedingly reasonable from the city's point of view.

Merrickville, Ont.

The Rideau Power Company are constructing a power plant on the Rideau River at Merrickville. The Wm. Hamilton Company, Limited, of Peterborough, are furnishing a horizontal turbine to develop 650 h.p. under 26 ft. head, to be direct connected to a Swedish General Electric Limited water wheel generator.

Montreal, Que.

The Montreal Council have issued a circular letter drawing the attention of traders to new by-laws in reference to the use of electrical signs projecting over the pavements. One regulation calls for direct illumination by uncovered electric bulbs for an area of three-quarters of the total sign space. Another section of the by-law compels owners of such signs to light the signs from dusk on six nights of the week and maintain them alight until midnight.

A contract for the electric lighting and fixtures of the Eglise St. Francois d'Assie, Ottawa, has been obtained by Mr. S. G. Bergevin, proprietor of the Peerless Lighting Company, St. Lawrence Boulevard, Montreal.

An appropriation of $40,000 has been made for the purpose of improving the Montreal civic street lighting system. Mr. A. Parent, the lighting superintendent, has prepared plans and specifications for the erection of standards and the placing of lights on a portion of St. Catherine and on Bleury streets; 142 lamps will be placed on the former thoroughfare and 45 on the latter. The standards will be 14½ feet high, and will each be surmounted with a single light.

The Quebec Legislature has inserted a clause in the Montreal Council's Bill permitting the Electric Service Commission to allow poles to be erected in lanes running parallel to streets wherein conduits are laid. The object is to save expense.

The success attending the inauguration of inverted arc lamps on ornamental standards in the city of Westmount, P.Q., has led to a decision to extend, during the present year, the system throughout St. Catherine Street and Victoria Avenue from St. Catherine Street to Sherbrooke Street and to introduce the smaller standard arc lamps in the same district on the cross streets, and as soon as finances permit to extend this system throughout the entire city. This will allow the removal of all unsightly poles from the streets which are now required for the other method of lighting. At the same time that conduits and cables were laid for this lighting, provision was also made for the carrying underground of the cables and wires of the police signal system, fire alarm, and the cables and wires of other lighting companies operating and passing through Westmount. When the work is completed, all poles can be removed from the streets. The Bell Telephone Company are co-operating with the city in this connection and are removing or have already removed the poles from the streets where the city has completed its work. On October 31 last the city had laid 227,500 feet of conduit, while the total cable installed was 71,190 feet. On the same date the city had 2,800 customers for light and power, the total kw. connected load being 3,916. The rate per street arc lamp (4 amp.) per annum was $55.00 and the rate for the standard arc lamp (6 amp.) $100.

Electrical interests are represented on the Council of the Montreal Metallurgical Association, recently formed, by Dr. A. Stansfield, of McGill, and Mr. J. D. Hathaway, of the Northern Electric, Limited. The former represents electric metallurgy and the latter copper.

The Siemens Company of Canada, Limited, Montreal, have received from the head office, London, England, copies of letters written by several of the firm's employees with H. M. forces on the European Continent and in Egypt and on warships. Men from the company's branches throughout the Empire have joined the forces and several have been killed and wounded. Some of the staff are officers, and others are serving in various capacities. A few served in the Boer war, and of these J. Burgess, at Spion Kop, received 16 bullet wounds. Another of those at the front in France was Lieut. J. M. Thornton (Royal Engineers), brother of Mr. K. B. Thornton, chief engineer of the Montreal Public Service Corporation. Lieut. Thornton, who was originally with the London Scottish, was wounded by a shrapnel bullet, but has since recovered. The letters give vivid descriptions of fighting by land and sea, relate narrow escapes—one man had a bullet through the tails of his great coat—and tell of the ruin caused by the Germans, and of adverse conditions, from the point of comfort, under which the men are fighting. All the letters, however, are of a very optimistic character, and are inspired with a confidence of ultimate and complete victory.

The annual report of the Marconi Wireless Telegraph Company of Canada shows that this company now operates forty stations in the Dominion of Canada, in Newfoundland,

and in Labrador; also that 93 Canadian steamers are equipped with the Marconi system. New stations have been installed at Port Burwell, Toronto and Kingston. The stations are divided as follows: 10 small station in Newfoundland and Labrador, 22 on the eastern coast of Canada, and 8 stations on the Great Lakes of Canada. The Newfoundland stations are subsidized to the amount of $4,630 per annum and the Canadian stations, to the amount of $89,200 per annum in all. Work on the contract with the Department of Railways and Canals for the construction of stations at Le Pas and Port Nelson has been pushed forward and will be completed during the present year. Communication has been established between these two latter points.

In the annual report of the town of St. Lambert, P.Q., it is stated that the number of services connected to the electric lighting system is 585, an increase of 118. The number of street lamps in service is 110.

Nelson, B.C.

A telephone line from Waneta to Nelson and through to Trail has been completed and communication established.

Nakusp, B.C.

The Brouse Telephone Company are issuing new stock with which to provide extensions and also to acquire the Nakusp town telephone system.

Newmarket, Ont.

A by-law was carried on February 23rd, authorizing the council to enter into a contract with the Toronto and York Radial Railway Company for the supply of power up to 500 h.p., the contract to run for five years, renewable for five-year periods thereafter. The ratepayers also authorized expending $15,000 for necessary extensions.

Ottawa, Ont.

Notice has been filed with the International Joint Commission concerning the applications of the St. Croix Water Power Company of the state of Maine and the Sprague Falls Manufacturing Company, Limited, a corporation organized under the laws of the Dominion of Canada. These companies are asking to be allowed to obstruct and divert the waters of the St. Croix River at or near Grand Falls, the said St. Croix River being boundary waters within the meaning of the treaty between the United States and Great Britain. All persons interested in the above applications are entitled to be heard with respect thereto before the Commission.

Prince Albert, Sask.

During the first week in February, a new automatic telephone system was placed in operation in Prince Albert. Connection was also made with the Colleston Rural Telephone Company, a farmers' line with a total of 40 subscribers.

Shelburne, Ont.

A by-law was recently passed, authorizing the issue of debentures amounting to $15,000 for the purpose of providing for the purchase of the present electric light plant by the corporation, and also to provide for the cost of additions to the distribution system.

Toronto, Ont.

The Interurban Electric Company have been awarded their account in full by Judge Denton against Mr. Jas. Lochrie, the owner of a brickyard. When Mr. Lochrie closed his brickyard recently, he failed to give notice of the termination of his contract in writing, as required by his agreement with the company.

A convention of municipalities from all over Ontario interested in the question of hydro radials was held in Toronto on February 24th.

The new Bloor Street car line, which has been constructed by the municipality of the city of Toronto, was formally placed in operation on Tuesday, February 23rd. This line has been supplied with three new cars and a sweeper. The cars are single truck, pay-as-you-enter type, 34 ft. long, the seats being arranged longitudinally; accommodation for 32 people. Cars are equipped with double end control and will, for a time, operate on single track, as the permanent line has not yet been constructed.

Mr. J. Shields, the recently appointed chief electrical inspector of the city of Toronto, is asking appropriations for a complete staff of 12 sub-inspectors as well as the necessary office assistants.

The Toronto Suburban Railway Company are making application to the Legislature of the Province of Ontario at its next session, for an Act authorizing the company to operate its railway on Sunday.

At a convention of the municipalities of Ontario interested in the construction of hydro radials, recently held in the Labor Temple, Toronto, some 200 delegates attended. It was announced by the chairman of the Provincial Commission, Sir Adam Beck, that work would probably be commenced on the Toronto-Port Perry line in the early spring, though much will depend on whether the Dominion Government will grant the mileage subsidy which it has been their policy to allow private organizations in the past. A constitution was adopted and the following officers elected:—Honorary President, Sir Adam Beck; Hon. Vice-presidents, I. B. Lucas, W. K. McNaught; President, James W. Lyon, Guelph; First Vice-president, Mayor T. L. Church, Toronto; Second Vice-president, ex-Mayor Graham, London; Third Vice-president, A. F. Wilson, Markham; Fourth Vice-president, Mayor Buller, Peterborough. District executives were appointed in the following order: Ex-Mayor Evanson, Prescott; T. F. Matthews, Peterborough; J. H. Downey, Whitby; Controller John O'Neill, Toronto; Peter Ray, East Flamboro; G. B. Ryan, Guelph; W. B. Johnson, St. Thomas; Mayor Clay, Windsor; R. Stirrett, Petrolea; D. McLaughlin, Stratford; W. C. Bush, St. Catharines; R. Lusch, Clarkson's.

Clarence Mackay, president of the Mackay Companies, intimated in his address at the annual meeting of the shareholders, that it might be found necessary in the near future to increase telegraph tolls. He argued that the railway companies of the United States had involved themselves in financial difficulties as a result of attempting to operate at too low a rate, and felt that the telegraph companies should profit by this experience.

St. Etienne, Que.

The Wm. Hamilton Company, Limited, of Peterborough, have recently shipped a horizontal twin turbine in steel case to Mr. J. G. Dunn, of St. Etienne, P.Q. This turbine will be installed on the Chateauguay River at Powerscourt, and will furnish power to Huntingdon, P.Q.

St. Marys, Ont.

At a recent meeting of council, the sum of $8,500 was apportioned to the electrical department, for installing a new lighting system.

The Water and Light Commission have decided against the opening of a hydro store in St. Marys, and will leave the handling of electrical supplies and appliances to the dealers and contractors.

Walkerton, Ont.

The Electric Light & Power Company of Walkerton, Ont., have offered to supply electric current, free of cost, to any manufacturer who may secure a contract for war material during the present war and carry out his contract in that town. Walkerton is the county town of Bruce, with a population of about 3,000, and with several good buildings which we are advised could be had for very reasonable rent or purchase and suitable for manufacturing purposes; both C. P. R. and G. T. R. connections.

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Pulse of General Public is Normal

It is encouraging to note the optimistic strain running through practically all the reports of our electrical utility companies as brought out in their annual statements, many of which have been made public within the last few weeks. It is probably safe to say that, in the majority of cases, gross earnings are in excess of those of 1913. This is all the more satisfactory as the earnings of these companies, the result of dealing directly, as they do, with the ultimate consumer, are a very reliable barometer of the sentiments of these consumers towards general expenditures. If the consumer were badly pinched, this would certainly show itself in such economies as reduced lighting bills and smaller transportation expenses. That such economies are not in evidence to any appreciable extent constitutes, then, a very satisfactory proof that the average consumer, though he may be guarded in his larger expenditures, has not been forced, and in all human probability will not be now, to forego the little semi-luxuries which electricity in its myriad uses renders possible at a minimum of cost.

But there is encouragement in these facts for more than the central station companies. If the customers of these companies continue to use current as before, this means that the field of the supply man for lamps, household utilities, etc., must at least continue in the neighborhood of normal proportions. This again will operate to the benefit of the manufacturers. So that the whole system of the machinery of our electrical trade—being dependent on the ultimate consumer, and the ultimate consumer having shown himself determined to jog along in normal fashion—gives every promise of regaining its equilibrium without further disturbance.

Where the electrical trade has been hit hardest is undoubtedly along the lines of what we may call "development" on extension work under present conditions and, even though equipment. Few corporations care to expend much money on extension work under present conditions, and even though urgent necessity exists, are making shift to get along in the meantime. This is not lost business, however, but is, for the most part, simply "deferred." The necessity for extension equipments is as urgent as it was before the war began, and this condition must, as time elapses, only become more aggravated. Those branches of the electrical industry that are hit the hardest now should, therefore, be the first to feel the beneficial results of a return to normal business conditions. Further than this, our home factories must profit by the enlarged fields of competition which will lie open, the crippled condition of part of our competitors, and a clearer home market as the result of certain of the equipment we now import being required abroad.

Of course, many of our smaller lines have suffered through the slackening in building activities. Even here, however, there is a possible compensation in the prosecution of business along new channels. For example, in the electrical contracting field the energy of the whole profession seems chiefly to have been directed in the past along the line of ruinous competition for new building business. As a matter of fact, however, it is claimed by many competent authorities that there is an equally profitable field, and in most cases much bigger, in the finished house business. In many ways, too, this is more satisfactory than the other, in that there is less delay, wiring can be done without annoying interruptions and intermissions, equipment can be installed, and current supplied within a few days, as compared with months in the average new building.

The moral seems to be that, as long as the ultimate consumer maintains his equilibrium, the electrical business of Canada is far from discouraging. This is a time for originality and individuality, a time to develop new lines, to perfect our organization, to "find a way or make it." Of course, the old business will come back, but confidence in this fact does not justify us in sitting down and waiting. We should be digging up something new, if for no other reason than that it will keep us occupied and prevent us from worrying. When the war is over, the new business we have found, added to the old business that will come back, will surely constitute that "era of unexampled prosperity" which even our real estate agents have hesitated to proclaim during the last few months.

Settling Disputes Expeditiously

A bill of considerable importance to the electrical and allied industries in Ontario has been introduced in the Provincial Legislature by the Minister of Lands, Forests and Mines. Briefly, the bill gives the Lt.-Governor in Council power to declare by proclamation that any river, stream or creek to which the Rivers and Streams Act is applicable shall be under the jurisdiction of the Minister of Lands, Forests and Mines, and that the Minister shall have power to determine, upon application to him by any parties concerned, all questions arising in relation to such river, as to the right to construct or use improvements thereon; the respective rights of persons using the river for the purpose of floating timber thereon; and the right to interfere with, alter or obstruct in any manner the flow of the water in such river. The decision of the Minister is to be final. The bill also states that no person shall construct a dam, weir or other structure or work upon any river except with the permission of the Minister of Lands, Forests and Mines, and under such condi-

tions as he may impose. The Minister is given power, if he deems it expedient, to have an inspection made of the river and to name an engineer for making the inspection. The Lt.-Governor in Council, upon the recommendation of the Minister, is empowered by the bill to make such regulations for the use and management of the work as he may deem proper. The Minister is given power to appoint an inspector to visit such river, or other rivers upon which improvements have heretofore been constructed in regard to which it is deemed expedient in the public interest that the use of the water should be regulated, so that all persons entitled to use it for lumbering, power or other purposes shall be given a reasonable and fair opportunity to carry on his project.

Where any conflict or dispute arises between persons having a right to use the river or any works or improvements thereon for lumbering, power or other purposes, the Minister may cause an inspection to be made and upon receipt of the inspector's report may appoint an officer to be in charge of the river or improvement or other works, who shall have power to regulate the use of the river or any works or improvements thereon in such manner as shall seem to him best calculated to afford the persons having diverse interests on the river or in the works or improvements a fair and reasonable use of the waters of the river.

Where it appears to the Minister that works or improvements on any river are in a state of disrepair he may, in writing, order the owner or occupier of such work or improvements to put them in proper condition for use and if the person named neglects or refuses to make the alterations or repairs the Minister may cause them to be made at the expense of the person named.

The main effect of this bill will be to simplify the matter of settling disputes between parties having diverse interests, such as lumber manufacturers and companies developing power, who formerly were obliged to have recourse to expensive legal proceedings. If the bill is enacted these parties will be able to bring their disputes before the Minister and have them more expeditiously settled.

Not the Sole Beneficiary

The following letter from the Commissioner of Calgary's Public Utilities, treating of the manufacturing possibilities of Canada, reached us too late for our Empire Number. Mr. Graves expresses the opinion that conditions in the west are adjusting themselves, so that cheap power and cheaper labor will make it possible to manufacture an increasing number of articles at such prices as to be more surely competitive with the articles we have been importing in the past,—

Editor Electrical News:

During the past three years the united efforts of Western Canadian cities have been directed towards building factories and inducing manufacturers to locate in the many towns and cities of the prairie provinces. From my observations, many of these factories so established were doomed to failure from their inception, a result oftentimes brought about either by lack of capital, limited market or want of scientific management and organization.

One of the greatest drawbacks to the progress of the manufacturer has been the cost of living and the high rents paid by workers for their homes, consequently, high wages had to prevail. These conditions now appear to be adjusting themselves, and in most cities cheap power is now available.

The manufacturers wishing to locate in the west, should, in my opinion, confine their activities to utilizing the natural or indigenous products of the country and on a sufficiently large scale to be able to reduce overhead costs and compete with American and foreign manufactures.

Canada, particularly the West needs most of all the farming class to fill up her vacant lands and thus create a home market for the manufacturer. To my way of thinking, a tariff that is set so high for the sole purpose of building up artificial industries is detrimental to the best interests of the country.

Let all of us encourage the "Made-in-Canada" movement, but let the manufacturer remember that he must not be the sole beneficiary!

(Signed) A. G. Graves,
Commissioner Public Utilities.

Calgary, Alta.

Favorable Utility Reports

At the annual meeting of the Bell Telephone Company of Canada, Limited, held recently in Montreal, Mr. C. F. Sise, president of the company and one of its most active officials for the past thirty-five years, announced his retirement from the presidency. The directors will be pleased to note, however, that a new position has been created which will enable the company to retain the invaluable experience of the former president. This position is that of chairman of the Board of Directors. Mr. L. B. McFarlane was elected president of the company. Announcement is also made of the resignation of two members of the board, viz., W. R. Driver, of Boston, and H. B. Thayer, New York. The vacancies were filled by the election of Messrs. T. Ahearn, Ottawa's well-known electrical financier, and Andrew J. Dawes, of Montreal. The board is now made up as follows: C. F. Sise, chairman; L. B. McFarlane, president and managing director; Hon. Robt. Mackay, Montreal, vice-president; Theo. N. Vail, New York, Robt. Archer, Montreal, Hugh Paton, Montreal, Chas. Cassils, Montreal, Z. A. Lash, K.C., Toronto, U. N. Bethell, New York, C. F. Sise, Jr., general manager, T. Ahearn, Ottawa, A. J. Dawes, Montreal.

The annual report states that two exchange buildings have been added to the company's real estate during the year and a large extension to the Adelaide Street building, Toronto, and to the Ontario Street building, Montreal. The company now owns 237,068 telephone stations (individual telephones) throughout Canada. The number of central offices is 460; number of employees, 7,836; number of miles of wire, 748,007; average daily exchange connections during 1914, 1,744,386; average daily long distance connections during 1914, 17,266. The number of miles of underground conduit in operation is now 279 or 1,754 miles of single duct; 782 miles of underground cable, comprising 433,424 miles of wire.

The gross revenue for 1914 was $9,599,026 on a capital liability of $40,852,099. This compares with $8,850,448 gross earnings in 1913. Net earnings for the past year after deducting operating expenses, maintenance, depreciation and taxes, are $2,212,617, as compared with $2,215,257 in 1913. Surplus earnings after deducting interest and dividend charges are $210,837 as compared with $503,732 the previous year. The surplus has been increased from $907,828, where it stood a year ago, to the even million dollars. The regular dividend of 8 per cent. has been paid.

Cedars Rapids Mfg. & Power Co.

At the annual meeting of the shareholders of the Cedars Rapids Manufacturing and Power Company, held recently in Montreal, the following board of directors was elected: J. E. Aldred, president; Howard Murray, vice-president; Sir Herbert Holt, J. S. Norris, D. Lorne McGibbon, Julian C. Smith, R. M. Wilson, Morton Otis, A. V. Davis. Mr. Julian C. Smith is general manager, Mr. R. M. Wilson, superintendent of operation, and Mr. J. S. Norris secretary-treasurer. It is stated that approximately 70,000 h.p. is already being delivered to their two customers, the Aluminum Company of America and the Montreal Light, Heat & Power Company.

(Reports continued on page 23)

75,000 kv.a. Steam Plant

The large steam turbine plant now being built by the Dominion Power & Transmission Company, of Hamilton, Canada, is situated on the Lake Ontario water front at the extreme north-east end of the city of Hamilton. The company's present principal source of power is the hydro-electric generating plant at Power Glen, near St. Catharines, and about 35 miles distant from Hamilton, where there is a head of 265 feet, the water used coming from Lake Erie, via the Welland Canal. Power is supplied to subsidiary companies in Welland, St. Catharines, Thorold, Port Colborne, Grimsby, Dundas, Brantford, Oakville, and Hamilton districts, but by far the largest portion goes to the city of Hamilton. Three separate transmission lines, at 45,000 volts, connect the Power Glen plant with the main switching station at Bartonville.

No high voltage transmission line is absolutely free from troubles, and in spite of having three separate lines, following different routes, the service is occasionally interrupted. The new steam plant is only one mile dstant from the switching section, and because of this short distance, the service between the steam plant and the switching station should be practically free from interruption.

The steam plant will be free from the ice troubles to which all hydro-electric plants are more or less subject in cold weather.

The plant has been designed for a capacity of 75,000 kv.a. The foundations are of concrete supported on piles, walls are of skeleton steel frame construction, filled in with pressed brick, and having terra cotta decoration, and concrete roofs will be used thorughout. Only one-half of the building is at present under construction, the progress to date being shown on Fig. 1.

The plant has been laid out so as to be operated, under normal conditions, on a strictly unit system. The general arrangement is shown by the cross-section in Fig 2. Each turbine generator is supplied with steam from its own boilers, with the piping arranged so that one set of spare boilers is sufficient for the whole plant.

The boilers are Edge Moor type, fitted with Taylor stokers, and have radial brick chimneys 240 feet high, a combination which will allow of the boilers being forced, if necessary, to 300 per cent. of normal rating.

Weather conditions during the winter months make it necessary to house in the coal unloading and handling equipment, and an entirely separate building is being provided for this purpose, into which the cars are run and dumped, or unloaded, into a large receiving hopper. From this hopper the coal is fed to the crusher, and then elevated to storage bins above the boilers, from which it goes to a travelling weigh hopper, is weighed and delivered to the stokers as required.

The turbine generator units are each of 12,500 kv.a. capacity, operating 6,600 volts, 3-phase, 66 2-3 cycles, 2,000 revolutions per minute, and are of the Westinghouse Parsons-Curtis type, equipped with surface condensers and Le Blanc air pumps. The circulating water for the condensers is supplied by pumps placed below the level of the water in the intake, which will always be self-priming and in condition to start up immediately in case of emergency.

The control room for the plant is situated in the centre of one side of the engine room, with windows extending into the latter, to enable the operator to have a clear view of the whole floor. A signal system is being installed with electrically operated Klaxons in both engine and boiler rooms, and with illuminated signs in control room, engine room and boiler room, each unit having its own pedestal. The arrangement will permit of the switchboard operator calling the attention of the machine operator and vice versa.

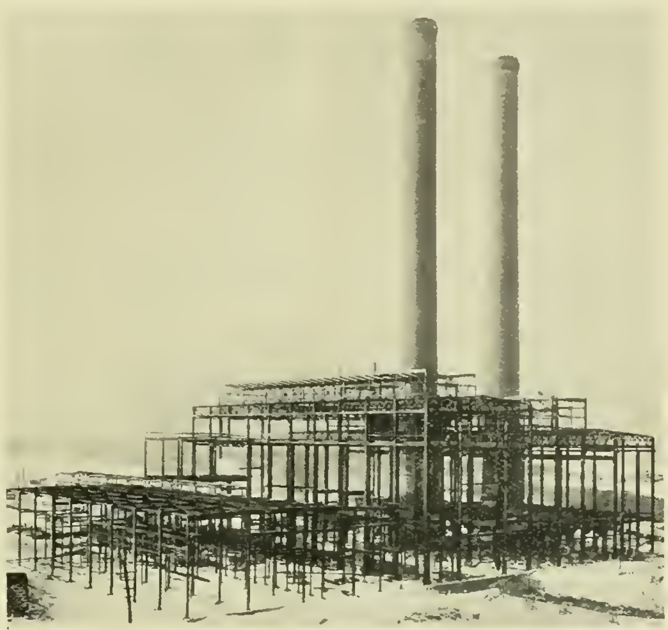


Fig. 1—Construction to date.

The current, being generated at 6,600 volts, has to be stepped up to 40,000 volts for transmission, the transformers and switching apparatus being placed in a building separated from the main plant.

It is to be noted that the plant is designed for continuous operation at high fuel economy, and is not intended solely for use as an emergency auxiliary. The reasons for this design are of a purely local nature and of no general interest.

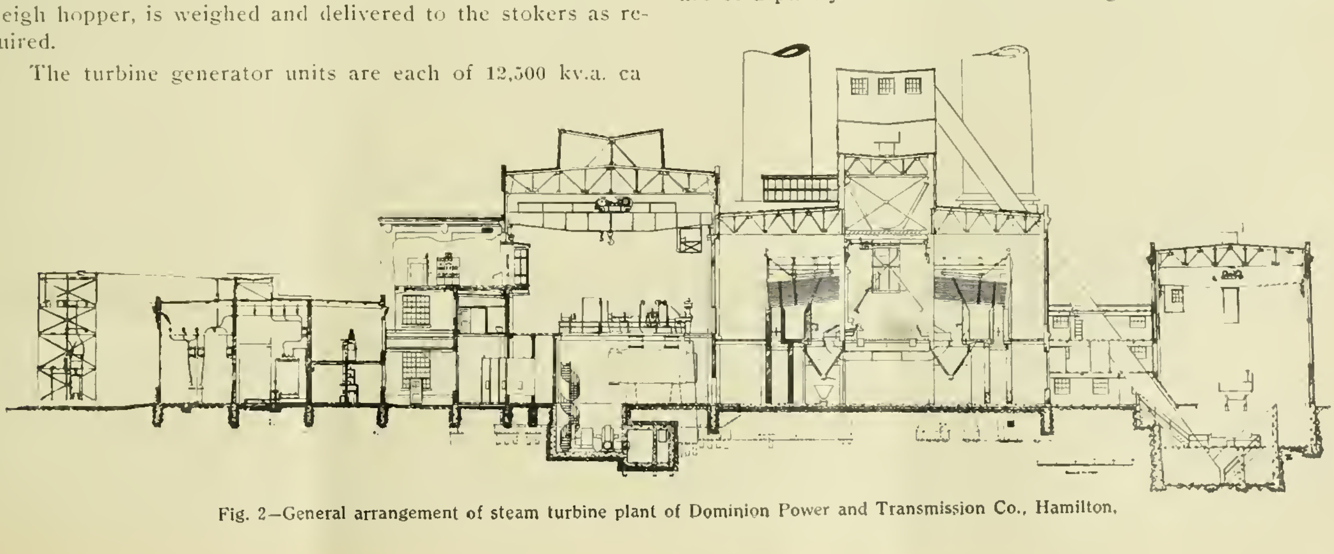


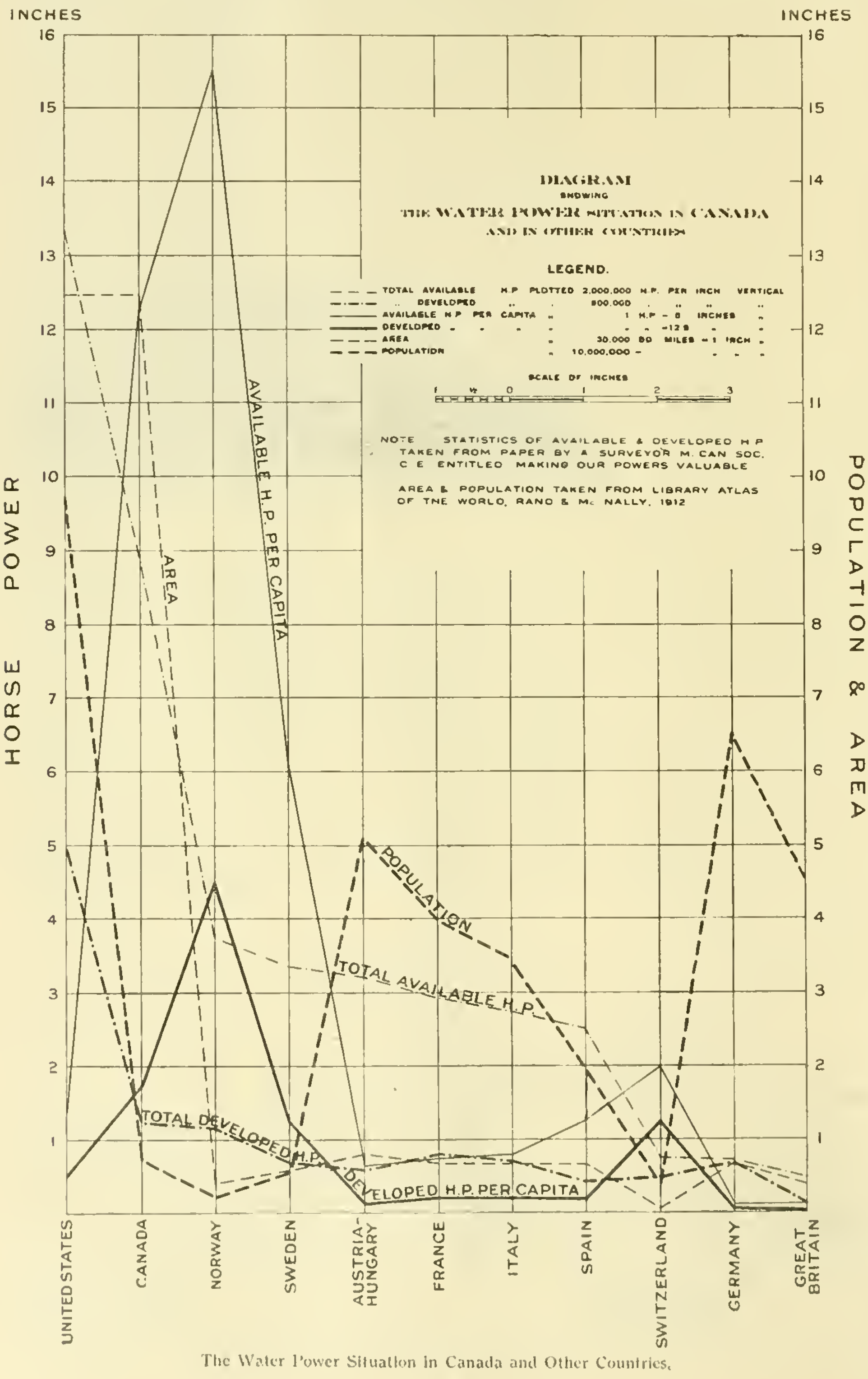
Fig. 2—General arrangement of steam turbine plant of Dominion Power and Transmission Co., Hamilton.

The Water Power Situation in Canada

Exceedingly Advantageous Location of Our Falls—Greatest per capita Development Except Norway—Greatest Total Available Except United States

By J. B. Challies, M. Can. Soc. C. E., Superintendent, Dominion Water Power Branch

A survey of the water power situation in the different countries of the world shows that Canada, the youngest of them all, has accomplished more in actual development and in use, than any except, perhaps, Norway. The outstanding feature of the power situation in Canada is the exceedingly fortunate and advantageous location of our water powers from the Atlantic to the Pacific. Practically every large city is to-day supplied with all the hydro-electric energy it can use from water power, the sources of which can be extended to meet all anticipated demands. Where the source of power is not water power, as in the middle western prairies, there is an abundance of either gas or good steam coal within immediate reach. There is probably no part of the present settled portions of the Dominion where power cannot be profitably produced from wholly Canadian sources. In case of necessity we can be, and in time we shall be, independent of all outside power-producing agencies.



The Water Power Situation in Canada and Other Countries.

All substantial and reasonably necessary power requirements throughout Canada have been met and provided for, and much pioneer work has been accomplished in adapting hydro-electric energy to new and highly profitable industrial use. In fact the water power situation strikingly demonstrates the faith of Canadians in our vast heritage. We have been extending an ever-widening net-work of transmission lines over our far-flung territories so that to-day, measured by population, we have the highest ratio of water horse-power of any other nation except Norway. On the other hand, as suggesting the room still left for expansion, we have the lowest ratio of water horse-power in proportion to area. The progress of power development in Canada has so far been based on sound engineering and sure economic principles, and there have therefore been very few financial failures. This has resulted in the popular delusion of the great potential value of undeveloped water powers, and in some districts in the general public being unduly apprehensive of the profits and powers of public utility corporations which control or develop existing water powers.

The great importance of our power resources, their successful adaptation for industrial use and for furnishing so much of our modern comfort has resulted in the general public taking a very marked interest in all questions pertaining to water power administration, investigation and use, and the question of suitable legislation covering water power administration and authorization has become one of the most important legislative topics not only in Canada but in other countries, notably in the United States. On the whole we are ex-

ceedingly fortunate in Canada, especially when we compare our conditions with those of the United States. Our water power laws are, in the main, quite adequate; encouraging to development with due regard to the public interest, present and future. While in some parts of Canada we may have outgrown former conditions and in such parts governmental machinery and laws with respect to water powers have not advanced as fast as might be desired, it must be remembered that there is but a short distance in time from the 50 h.p. overshot mill wheel of small efficiency and crude apparatus of local use and of little general importance to the community at large, to the 20,000 h.p. turbine of over 90 per cent. efficiency and 200-mile transmission line of to-day of such widespread importance owing to the present universality of the electrical industry. I am confident that in a very short time our legislators in all parts of the Dominion will have realized the advantage of and have put into force an efficient water power administration providing reasonable laws under which water power development will be fostered with due protection to the public interest.

In the lull which has temporarily supervened in power development in Canada, we can look back with satisfaction upon a long period of uninterrupted prosperity and marvellous expansion. This lull should enable the Dominion and Provincial Government Departments interested in water power matters to perfect their arrangements for securing that physical and economic data which is always essential and a necessary preliminary to the financing of new water power developments.

While in the past there has been a great lack of reliable data regarding Canadian water powers, there is now much excellent work under way throughout the Dominion which if continued and extended without delay, will result in sufficient data being obtained regarding all powers within transmission radius of present or prospective commercial centres being available for consideration when the present financial stringency is relieved.

It has been said that that the use of power in Canada for electro-chemistry, electro-metallurgy, and electro-siderurgy, has not kept pace with the advance made in these arts in other countries, and on the other hand that certain European countries are using about one-half of their developed water powers for these latter purposes. It must be admitted that most of the developed power in Canada is used for motive power, traction and lighting, and but a small percentage for electro-chemistry, electro-metallurgy, and electro-siderurgy. This condition of affairs is probably the result of a young country first, meeting its most urgent permanent and "primitive" power requirements, that is, for lighting, traction and motive purposes, and to temporarily postpone the extensive and intensive adaptation of power for electro-chemical and electro-metallurgical purposes; at any rate until adverse economic conditions and financial hazards surrounding the use of power for such purposes have been overcome. One thing certain, no country in the world has realized greater benefit from the advantages of hydro-electric power for domestic, municipal, and manufacturing purposes, than have the people of the Province of Ontario, thanks to the Ontario Hydro-electric Commission.

In a general way any considerable extension to existing power plants and the development of additional water powers must depend primarily upon the demand for power from traction, lighting, and motive power sources, and but secondarily on the possible use of power for electro-chemical, electro-metallurgical, and electro-siderurgical purposes; of course the use of power for pulp-making alone excepted. Unless we use our power to supply the ever-increasing demand from our southern neighbors in the United States, the first use of power will grow directly with the increase in our population, slowly and steadily at any rate for the next decade. For any considerable increase in our present power demand, except power required for pulp-making, we must depend largely on proving the commercial possibilities of the use of power for electro-chemical and electro-metallurgical purposes.

Favorable Utility Reports (con.)

The report of the Winnipeg Electric Railway Company for the year ending December 31st, 1914, shows gross receipts of $4,101,302, as compared with $4,078,694 in 1913. Net earnings, however, are slightly less, being $1,685,093, as against $1,826,087 in 1913. This is partly accounted for by a reduction of about 2 per cent. in the number of passengers carried. During the year the company added twenty large double truck closed motor cars manufactured in their own shop, in addition to considerable extensions to their electric lighting and power distribution system. About 7½ miles of new track have been laid.

Canadian General Electric

The annual statement of the Canadian General Electric Company showed gross profits for the year ended December 31st, 1914, of $914,527. This compares with $2,029,898 for the corresponding period in 1913. Net profits are $723,571, as compared with $1,336,309 in 1913. The usual dividends were paid. A very favorable feature of the report is the reduction in liabilities to the amount of over $4,000,000. Two new directors were elected, viz., H. C. Cox, president Canada Life Assurance Company, and Lt.-Col. J. S. Hendrie, Lieut.-Governor of Ontario.

City of Port Arthur

The annual statement of the electrical department of the city of Port Arthur for the year ending December 31st, 1914, shows the following encouraging figures,—revenue, $179,294.93; operating expenses, $82,264.32; gross profit from operating, $97,030.61; interest and sinking fund charges, $40,489.67; reserve for bad debts, $1,302.02; net profit, $55,238.92. Mr. J. J. Hackney is Commissioner of Utilities.

Calgary Power Company

The annual report of the Calgary Power Company for the year ending December 31st, 1914, showed gross earnings of $231,185, as against $240,116 in 1913. Net earnings for the past year were $180,206, as against $188,060 the previous year. The total assets of the company are placed at $5,220,515. Mr. R. B. Bennett is president of the company.

St. John Railway Company

The annual statement of the St. John Railway Company shows profits for the year 1914, after providing for interest on bonds and all other charges, amounting to $73,908, as against $66,328 a year ago. This amounted to 7.5 per cent. on common stock, as against 7.8 in 1913. This company has paid a 6 per cent. dividend since 1906.

Hydro System for Roberval, P. Q.

The city of Roberval, Que., is planning to install a hydro system for lighting purposes. The equipment has not yet been purchased. The turbine will operate under a head of 60 ft., and the capacity of the river is about 5,300 cu. ft. per minute. It is planned to carry the water in a wooden conduit 7 ft. in diameter and 11,000 ft. in length, though a steel conduit slightly smaller may be used if the added expense is not great. The plans at present being considered call for a twin, centre discharge turbine, direct connected to the dynamo. The transmission line will be three-phase, about 2½ miles long. A complete distribution system will also be required for the city of Roberval.

Electric Pumps for Sewage Disposal

The City of Chilliwack, B. C., another city to prove the worth of the Electric Motor Pump—A short description of the system

By D. P. Dunn, A.I.E.E.

CHILLIWACK, the capital city of the Municipality of Chilliwack, is situated in the Fraser Valley, on the transcontinental lines of the Canadian Northern Railway and the Great Northern Railway. It is seventy miles from Vancouver, B.C., and fifty-eight miles from New Westminster. The city is the eastern terminus of the British Columbia Electric Railway inter-urban line, on which several electric trains run daily to and from Vancouver, New Westminster and the intermediate points. The population of the city, which is increasing, is 2,500 and of the municipality 6,000.

The water is brought down from a mountain stream some eight miles away from the city. This water is laid on practically all the roads throughout the Valley. Electric light and power are furnished by the B. C. E. Ry. Company, Limited. A local company supplies telephone communication throughout the city and surrounding district and gives long distance connection with coast points.

The Chilliwack Valley stretches from Sumas Lake on the west to the foothills on the extreme east, a distance of twenty miles. The Valley is about six miles wide at its broadest point. It is drained by the Fraser River, which flows along the North-West side. The soil for the most part consists of loam, it being a mixture of river sediment with volcanic washings from the Coast Range of mountains. The soil has a depth of from three to ten feet, and is rich in phosphates. The sub-soil is silt. Sand and gravel form the medium of natural sub-irrigation. The climate is temperate and extremes are not general. The rainfall is fairly heavy during winter, the average annual rainfall for a period of ten years being 62 in. Electric storms seldom occur, and irrigation is not required. The chief industry of the Valley is dairying. Fruit growing and poultry farming are also followed with success.

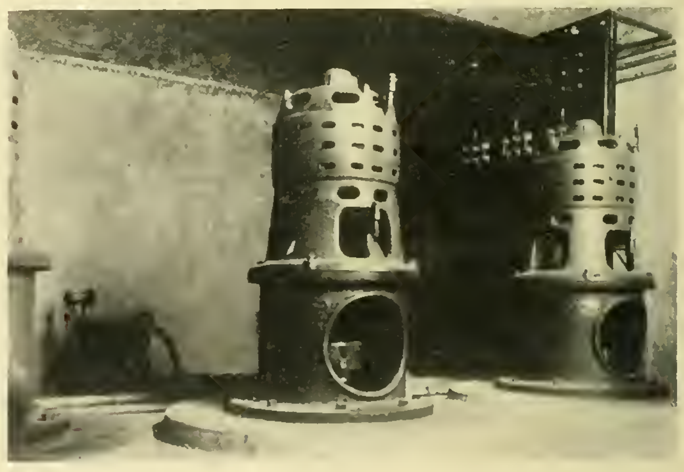
For some years the city has desired to have a proper sewer system, the old system of installing septic tanks throughout the district having become a nuisance in times of heavy rains during the winter months, and a menace to the public health—owing to the overflowing of these tanks. Further, no provision could be made for installing storm drains to take off the surplus water during such times. In the beginning of 1914 the city decided to install a sewer system and called for tenders and plans. The work was intrusted to Messrs. Cleveland & Cameron, civil engineers, of Vancouver, who let the contract to Messrs. Robt. McLean & Company, general contractors, Vancouver, B.C.

The original scheme provided for the use of pneumatic ejectors at two or more points within the district, this being afterwards discarded owing to the prohibitive cost.

In the summer, during high water from the Fraser River, when the rise is extreme, the level of the city is below the level of high water. However, a most efficient system of dyking was constructed some years ago, the defence work surrounding the greater part of the city. The average formation in the city consists of depths of from seven to nine feet of alluvial deposit overlying quicksand and gravel. Where the alluvium is of sufficient depth the work of sewering is about as easy as it is in any formation, but where the depths of the sewer penetrate the sand and the gravel the work becomes one of extreme difficulty. The necessity of providing for the draining of basements in the business part of the city causes the sewers to have to be laid to a depth of over ten feet, which, for a considerable length, is below the quicksand.

The project that is being carried out consists of outfall works, placed at sufficient height, a pumping chamber at the lowest point in the district, and a series of sewers ranging from 12 in. to 6 in. in diameter with a rising main from the pump well to the outfall works. The scheme is on the separator system of sewerage and the cost of the works is about $35,000. The work was started about the commencement of May, 1914, and finished toward the end of December of the same year. The sewers are constructed with vitrified pipes, jointed with cement, with the usual manholes built in concrete at intersections and changes of gradient. The pumping chamber is constructed of concrete and the upper portion contains the pumping machinery. This consists of centrifugal pumps, in triplicate, supplied by the Canadian Fairbanks-Morse Company, Limited, of Vancouver, B.C. The pumps are driven by induction motors of the squirrel-cage type. The sewage from that point is delivered by the rising main to the outfall works on land onto the bank of the Lily Slough.

Each pump has a capacity of 200 gals. per minute against a total head of thirty-three feet. The outfall works consist of detrital chamber and separator in duplicate, each being provided with controlling valves for alternating the flow and removing the solids. The detrital tanks are of the usual hopper bottom shape with surface scum boards. The separator consists of the same hopper shape pattern, the outlet from them being by a series of weirs and channels drawing the liquid from the top by a series of thin films. With this combination over 90 per cent. of the solids in suspension are removed. The effluent is sufficiently clarified to be discharged into a stream or used for further purification on filters. The detrital tanks and separator are built entirely of concrete. The scheme provides for the sewage from a population of five thousand at the rate of 100 gals. per head per day. This system is the only one of its kind operating in British Columbia and it is quite a success.



Two of the motors at the Chilliwack plant. Switchboard and automatic oiling system in rear.

The grading of the main sewer piping throughout the city varies from .22 to .45 per cent. The distance from the

centre of the city to the pumping chamber is, roughly, 6,000 ft., and from the chamber to the separator tank 4,000 ft., the average grade of the rising main being .034 per cent. The total loss in friction in the pipes, pumping equipment, etc., amounts to 5 per cent. The amount of head that the pumps have to contend with at the pumping chamber is 15.8 ft. This includes losses, while at the separating tank an additional head of 11.32 ft. is encountered. In the rising main about 1.36 ft. is lost owing to friction. Thus the total head for the pumps to operate against is 28.48 ft., say 28.5 ft.

Considerable difficulty was encountered in laying the pipes in certain portion of the city, owing to the quicksand in the lower strata. On several occasions after the pipes had been laid and filled in, a cave-in occurred in the roadway which necessitated its being torn up and renewed. To offset this difficulty, sheet and stool piling had to be resorted to. In some cases this was driven down to a depth of from 15 ft. to 20 ft.

During the construction of the pump chamber, which is of solid reinforced concrete, with walls one foot thick and a total depth of 21 ft., resting on a natural gravel formation, an excavation had to be made 20 ft. x 25 ft. and 2t ft. deep. This took several weeks to complete owing to the difficulty of getting rid of the water, which appeared at only three feet below the ground surface. A centrifugal pump operated by an eleven horse-power induction motor, with a speed of 1,130 r.p.m. and a pump capacity of 300 gals. per min., was in continuous operation. At certain periods two gasoline-engine-driven plunger type pumps of 5 h.p. each were used as auxiliaries.

During the laying of the concrete foundation, the blowholes kept appearing. This difficulty was overcome by plugging with a half-inch iron pipe and then filling with cement. Two manholes extending two feet above the road surface are provided—one for lowering machinery into the chamber, and the other for the inspection of apparatus. On completion, the chamber was subjected to a 48-hour test for leakage and completely submerged. This was done to satisfy the city officials, who declared it to be quite watertight.

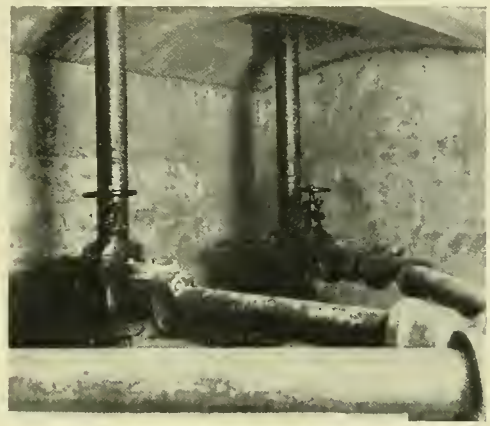
The pumping equipment includes three 3-in. Byron Jackson vertical centrifugal pumps, bottom suction, equipped with brass open runners and brass shafting. The pumps are so designed that none of the bearings can come into contact with the sewage, and the self-oiling thrust bearings are placed inside the motor bases, where they are easily accessible. The suction pipes are 5-in. cast iron, while the outlets are 3-in. cast iron. These three pipes join a common main of 6-in. cast iron and are led through a diminishing pipe (12-in. to 6-in.) to the rising main. With this arrangement of bearings in motor bases it is not necessary to withdraw the entire unit to raise the sump cover when it is desired to examine the bearings. On each pump is mounted a 5 h.p., type UH, Fairbanks-Morse vertical induction motor 220 volts, 60 cycles, 3-phase, 1200 r.p.m. direct connected through a flexible coupling.

The motors are in the top chamber while the pumps are situated in the lower chamber, the shaft which connects the two being about 6 ft. in length. The bottom part of the sewage chamber is divided into two sections; in one section the sewage collects and is led to the pumps through the dividing wall. The pumps themselves are dry and accessible at all times, but being set below the level of the sewage they are practically submerged so far as priming is concerned. They are controlled by a 5-in. gate-valve on the suction side and a 3-in. gate-valve on the outlet. A 3-in. check-valve is placed on the outlet side, which serves to stop back flow to an idle pump.

A special feature of this direct connected pump is non-overloading. The constant horse-power characteristic insures long life to the motors and avoids disputes with power companies who prefer this type because it enables them to figure on a constant load factor.

Motors

The motors are of the same electrical design and construction as the horizontal machines, the difference being in the frame, shaft, and bearings. The problem of efficient lubrication of the vertical shaft, and the support of the rotor, are both successfully solved by the use of ball-bearings throughout. The thrust being mounted in the upper bearing bracket is easy of access; it rests on a self-aligning seat and takes all the weight of the rotor. Two sets of radial bearings are used whose outer races are free to adjust themselves to the easiest running position; each bearing is independently lubricated by an improved automatic oiling system whereby the flow of oil may be seen at all times. The rotors are of the indestructible type with cast-on end rings. These motors when operating under full load at normal voltage and frequency have a temperature rise of not over 40 deg. C. They carry 25 per cent. overload for two hours immediately succeeding a full load run, with a rise of temperature not exceeding 55 deg. C. above the surrounding air. They will also carry 50 per cent. overload without varying (based on a room temperature of 25 deg. C.) or corrected for different values in accordance with the rules of the A.I.E.E. At normal frequency the motors will operate at full load on any voltage within 10 per cent. of normal, and at normal voltage the same departure from frequency may be made.


The bottom chamber where pumps are located.

Control

An automatic float-switch is provided to each motor, and a control panel installed by means of which any motor may be connected to any one of the three controls, or disconnected from the system; a maximum of flexibility is thus possible. The service is a three-wire, lead-covered cable run from the power company's transformers, carried underground in conduit to the motors.

The main fuses are rated at 60 amp. 250 volts, together with a three-pole line switch on the same rating. There are three branch circuits, one to each motor, fused at 30 amps. each. These are all laid in open conduit. The service leads are of No. 4 copper, stranded, the cable being tested for 2,000 volts. This is laid at a depth of 3.5 ft. and brought from the company's transformers through a pot-head located on a pole, where it enters the ground and runs for a distance of 50 ft. to the pump chamber. The transformers consist of three 5 kw. units (pole type) connected in delta on the primary and secondary sides, the voltage being 2300/1150—220/110 volts. These are tapped off at 2,300 volts, 3-phase feeder of No. 8 weather-proof copper and are situated about a mile from the B. C. E. Railway Company's sub-station.

Such a service constitutes a very desirable load from the power company's point of view on account of its regularity.

Electric Railways

Street Railway Track Construction

By H. J. Tippett*

Introduction

The subject of street railway track construction covers a very extensive field, and when one considers that there are somewhere in the neighborhood of forty-five thousand miles of street railway on this continent, and that some of it is costing in the neighborhood of $50,000 per mile of single track, it will be agreed that the original construction and its subsequent maintenance is one full of engineering interests.

The subject could be split up into a great many parts, on account of the materials used and the methods of carrying out the work, and each item could probably be made a subject of a paper in itself, but with the limited time at our disposal it is merely possible to run over the subject in briefest outline.

So much of interest in this subject is bound up in and is virtually a part of the early histories of railways that it was felt the article would not be complete without a brief reference to the origin of ways and the development of materials which are common in railway engineering of to-day.

Historical

The railway track more than any other part of railway equipment had a crude beginning, and has reached its present condition of excellency by a continuous series of improvements.

In the year 1630 a Mr. Beaumont, of Newcastle-on-Tyne, took the lead in a movement to facilitate the conveyance of coal from the mines to points of shipment by means of wooden-ways consisting of cross sleepers or ties placed 2 ft. apart, on which were nailed wooden planks or rails 6 ft. long and 4 in. wide. Like many other pioneers, he lost his entire fortune in this and other schemes for mine development, and died in poverty. His idea, however, lived on and was improved about 1640 by covering the tops of the wooden rails with cast-iron plates to prevent the attrition caused by the wheels. The next improvement saw these plates made with an upright side or flange to keep the wagons on the track. This operation was called plating the wooden rails, from which the appellation "Platelayer" comes, which to this day is the name given to the trackmen in Great Britain. These plates came to be called "Snake Rails," on account of their liability to become loose and suddenly dart upwards, sometimes passing through the floor of the wagon and injuring passengers, and the wagons were often derailed in this way. It became a common practice for a heavy sledge hammer to be carried on the wagons and if any plates became loose the wagon would be stopped and the plate fastened down before proceeding.

With the development of the iron industry the transfer from plated wooden rails to cast-iron rails was a natural one. Cast-iron flanged rails 3 ft. long and 4 in. wide were first used at Whitehaven in 1738. These were made in what was called the "Fish Belly Pattern," that is, with the flange of wider cross section at the centre of the rail than at the end of the rail.

In 1789 William Jessop brought about an important advance by introducing at Loughborough, Leicestershire, edge rails, so called because the wheels ran along the top edge and were not guided by a flange on the rail but by a flange on the wheel. These rails were also cast in 3 ft. lengths and 1½ in. wide on top; they were also of the fish belly pattern, but had projections from the base at each end through which they were fastened to the ties. It was soon found, however, that these projections broke off and then there was no way of holding the rail. This brought about the next great improvement, namely, that of casting a rail holder as a separate chair or pedestal, and this type, though slightly improved, is, as we know, the type in general use throughout Great Britain to-day.

James Outram was also responsible for the laying of railways for Derbyshire Collieries. These were laid about 1795 and were in use as recently as 1911, they were known as "Outram Ways," and later as "Tramways." Whether the word "Tram" was a contraction of Outram or came from the old Swedish word tram, which means beam of wood, is in doubt, but the name "Tramways" still holds good throughout Europe.

Jessop, too, was responsible for the standard 4 ft. 8½ in. gauge, which is universal to-day. It is easily seen how this came about. All his rails were 1¾ in. wide on the head and he made the distance between the rails on all the tracks which he laid an overall dimension of 5 ft.—that is, between outside edges of his rails; this gave a dimension of 4 ft. 8½ in. between what we term to-day gauge edges of the rails.

Some thirty-six years later, when consulted about the width of gauge for his new Stockton-Darlington railway, George Stevenson said, with broadmindedness and foresight, "make it the same as Jessop's—our tracks may be a long way apart at present, but depend upon it, it will not be long before they are connected up."

It was not until 1795 that the first wooden railway was built on this continent; this was on Beacon Hill, Boston, and even thirty years later we find the Quincy Railway, in Massachusetts, 4 miles long, built of wooden rails 6 in. wide and 12 in. high, with the old iron plates or snake rails on top and resting on stone sleepers 8 ft. apart.

In 1825 America was awakening to greater interest in this method of transportation, and sent William Strickland from Pennsylvania to England to collect detailed information on transportation in general and railways in particular.

In 1830 the present-day T rail originated—Robert L. Stevens, of Hoboken, when on his way to England to buy rails for a proposed road, devoted considerable time whittling out cross sections of what he thought would be a good kind of rail. The best then known in Europe was the T rail without any base, requiring a chair on every tie. Stevens spent considerable time in England before he could get a manufacturer to even consider making his rail with the flat base. He held on, however, and succeeded in getting the

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first H rails, as they were then called, made by promising to accept the responsibility for damage to the mill and possible loss of life that might result from so hazardous an undertaking! These rails were, however, eventually rolled and of wrought iron 16 ft. long, height 3½ in., width of head 2⅛ in., width of base 3¼ in., with a weight of about 39½ lbs. per yard. Stevens never patented his rail and lived to regret his omission to do so. In Europe it was developed by C. B. Vignole, and to-day is more commonly known as the "Vignole" rail on that continent.

It was not until 1855 that iron rails were first manufactured in America. In 1863 Bessemer steel was invented. Thus we find the original ideas of Beaumont, Jessop, Stevenson and Stevens to be the basis of railway track construction to-day.

Method of Traction

(The method of traction to-day through city streets may be of several kinds—cars may be hauled by horses or cable, operated on the electric conduit storage battery systems or overhead trolley system, the third rail and catenary systems are confined chiefly to interurban railways, which are outside our subject to-night.)

In England the construction of tramways proceeded more rapidly after the passing of the Tramway Act in 1870.

It has been proved conclusively that the overhead trolley system for handling city traffic has been the most economical to adopt from an operating standpoint, and the other systems are more usually adopted to take care of some local features for which they are better suited. Richmond, Virginia, had the first electric motor street railway. This commenced operating in 1888.

The following figures give some idea of how the different systems compare numerically on the North American continent:—

Overhead trolley systems	1100
Storage battery systems (mostly small companies)	50
Cable systems	2
Electric conduit systems	2
Horse traction systems	1
Trackless trolley systems	1

Modern Track Construction

The types of paved track construction for use on overhead trolley systems may be divided into three general groups.

Type 1.—That in which no ties are used; the rails are temporarily surfaced to grade on stone blocks and held to gauge by steel tie rods and are then concreted in solidly, the concrete coming over the rail flange. This type is common in Great Britain.

Type 2.—That in which the rails are surfaced to grade by as few ties as possible, ties being spaced about 8 ft. centre to centre. The rails also held to gauge by steel tie rods and then concreted in. This type has seen limited use on this continent. In these types the concrete is usually deeper under the rail than between the rails, thus forming a longitudinal stringer or concrete beam.

Type 3.—That in which the rails are surfaced to grade on as many ties as can be conveniently placed under them without interfering with the operation of surfacing. These ties are usually spaced 18 in. or 2 ft. centre to centre. In this type the concrete is usually of the same thickness under as between the rails. This is also the most common type in use on this continent, though its details are again split up into different classes to adapt it to local conditions. It closely follows regular steam road practice; and the fact that it is very adaptable to both good and bad subgrades alike has brought it into general favor.

Let us consider foundations for a minute. In comparing types 2 and 3, type 3 makes use of the maximum bearing area attainable on the subgrade. Type 2, however, by the use of a longitudinal concrete stringer under the rail reduces this area to only a little over one-third that of type 3, because it has many less ties and the greater thickness of concrete under the rail makes a line of structural weakness between such longitudinal concrete stringers and the shallower concrete between the stringers. In many cities also the variable nature of the subgrades generally met with in laying track on city streets has proved the necessity of the greatest possible bearing area.

It will be noticed that Philadelphia, Fig. 1, ties the two concrete beams together with reinforcement, nor are the beams as heavy as is the case in Vancouver. In the Cleveland type, again, the stringers or beams are not of so great a depth. In each of these cross-sections it will be noticed that the subgrades require considerable care in preparation,

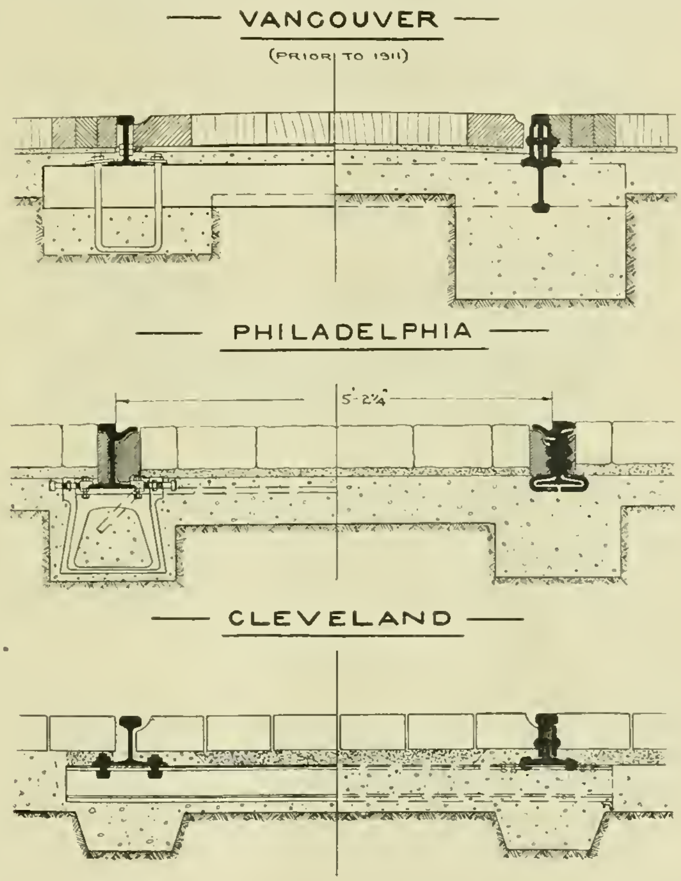


Fig. 1

VANCOUVER (Prior to 1911)—Concrete, 1:2½:5; ties, 6 in. x 8 in. x 7 ft., 8 ft. c. to c.; spikes, R. R. 9 16 in. x 5½ in.; rails, 7-in. 70-lb. Tee; joints, reinforced; bonds, two 3 ft. plugs; tie rods ¾-in. round.

PHILDELPHIA—Concrete, 1:3:6; ties, none, C. 1. chairs used 4 ft. c. to c.; spikes, ¾-in. bolt with clip; rails, 9-in. 91-lb. groove; joints, Nichols composite; bonds, none; tie rods, none.

CLEVELAND—Concrete, 1:6; ties, Carnegie steel 4¼ in. x 6 in. x 6 ft. 6 in. 4 ft. c. to c.; spikes, bolt and clip; rails, 7-in. 95-lb. Tee; joints, Clark rivet and welded; bonds, none; tie rods, ⅜ in. x 2 in. 5 ft. c. to c.

and much of the ground between stringers is liable to be broken up and remade and therefore not so homogeneous and satisfactory as undisturbed ground. In placing the concrete, too, the dirt from the sides of the trenches is liable to be mixed with it. On account of settlement of made ground and the difficulty in holding the rails, owing to there being so few ties, this type has not been very successful here.

Referring to other details of Fig. 1, I would just mention that the left-half is a cross-section of the construction at a tie or chair, and the right-half a cross-section through the rail joint, to show the different types of joints used. In this old Vancouver type the ties were only 7 ft. long; we have increased these to 8 ft. long in the new type, which will be

noted later. No tie plates were used under the rail, and the joints were of what was called the "reinforced" type; that is, a piece of rail 4 ft. long of the same section was inverted and riveted onto the base of the two abutting rails. This had the advantage also of acting as an anchor. The rail 7 in. deep, weighed 70 lb. per yard, which while admissible on light traffic lines is not suitable for the down-town traffic of to-day.

The effect of lateral pressure exerted by wood block pavement on a too light rail is often considerable, the rail being insufficiently stiff and insufficiently fastened to resist such pressures, which are sometimes considerable. The Philadelphia type has no ties, but cast-iron chairs are substituted; these are spaced 4 ft. centre to centre. The rail joint is of the Nichols type. The fish plates, which are not made to fit the rail top and bottom, are riveted onto both sides of the web with twelve 1-in. rivets, the space at the top and bottom being then run with zinc—no electric bonding is required.

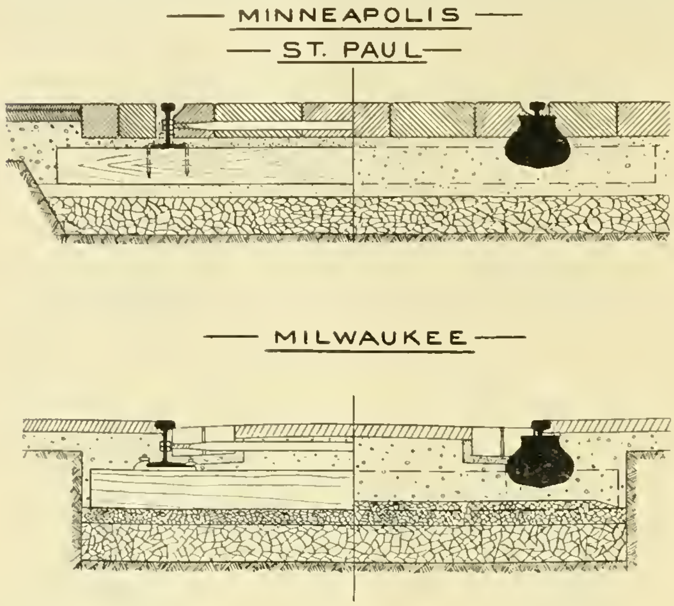


Fig. 2

MINNEAPOLIS, ST. PAUL—Rock ballast, 6 ins. rock and 2 ins. gravel under ties; ties, creosoted pine 6 ins. x 8 ins. x 8 ft. 2 ft. c. to c.; spikes, R. R. 9/16 in. x 5½ in.; rail, 7-in. 91-lb. Tee; joints, cast welded; bonds, none; tie rods, ⅞ in. x 1½ in. 10 ft. c. to c.

MILWAUKEE—Rock ballast, 8 in. under ties; ties, pine, white oak 6 in. x 8 in. x 7 ft. 24 in. c. to c.; spikes, ⅞-in. screw; rail, 7-in. 95-lb. Tee; joints, cast welded; bonds, none; tie rods, 5/16 in. x 2 in. 6 ft. c. to c.

The Cleveland type calls for steel ties exclusively, and to overcome the increased liability to rail corrugation from so rigid a type of construction the carbon content in the rail steel has been increased from .75 to .8 per cent., and the rail steel is also treated with .1 per cent. of metallic titanium alloy to offset the tendency to brittleness. The steel ties are spaced 4 ft. centre to centre. The Clark joint is used. In this the plates make a tight fit with the rail at all points and eight 1⅛ in. rivets are put in under considerable pressure and the base of the rail is thermit welded—no electric bonding is required.

As previously stated, that type in which the ties are more numerous, is the most popular on this continent. This type may itself be subdivided into three classes:—

Class A, where the ties are laid on a crushed rock or gravel foundation requiring drainage, with no concrete under the ties.

Class B, where the ties are laid temporarily on blocking at each end and are then concreted solidly in, in one operation.

Class C, where the ties are placed on a previously laid concrete slab and then surfaced to grade on a cushion of sand or fine rock and the remaining concrete put in after the track proper is completed. Other types than these are considered in the light of exceptions to the general rule.

The type using the crushed rock or gravel foundation is quite popular in a number of important cities. It has, nevertheless, been abandoned in others, owing to the poor bearing qualities of the soil, good bearing qualities being essential to the use of this type. Those using it did so usually because—First: they avoided the ten days which must be allowed for a concrete foundation to set, and therefore they can turn traffic onto it with a minimum interruption to the car service. Secondly; because it is claimed to be more resilient and therefore less noisy and less conducive to rail corrugation than when the track is laid on concrete. Good as such a foundation may be if well rolled and drained, it is not to be recommended where the subgrade lacks uniformity, as the crushed stone does not act as a unit in the same way as concrete, the load on each tie being transmitted to the subgrade independently, and for this reason it is not possible to provide against settlement of the track over sewer or water trenches so often cut across the tracks, or holes that have been back-filled. This is perhaps its most serious drawback, particularly in new cities. In reconstructing this class of track it is not necessary, of course, to excavate deeper than the bottom of the ties.

Milwaukee, Minneapolis and St. Paul construction (Class A foundation) is shown in Fig. 2. Minneapolis uses gravel or rock; sometimes neither, however, is necessary, as a good natural gravel runs up to the surface of the ground in many places which is taken advantage of, the ties being laid directly upon it. If crushed rock is laid the ties are surfaced up with gravel; this tends to fill the voids in the top of the rock and to prevent the lighter mortar in the paving concrete from running away from it. The rails, 91 lb., 7-in. "T" rail, are the same as used recently on some Vancouver work; the fasteners, regular railroad spikes and tie rods. The joints are of the cast welded type; these are made by running molten steel from a portable cupola into

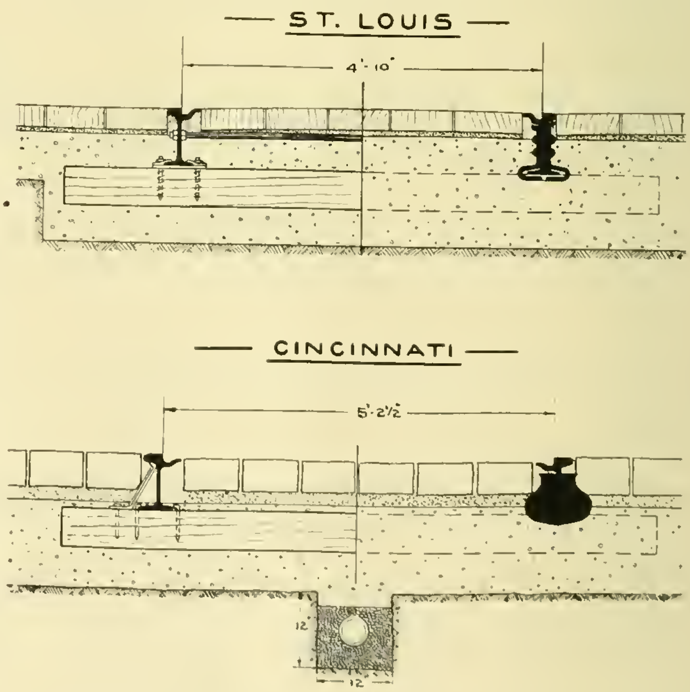


Fig. 3

ST. LOUIS—Concrete, 1:3¼:6½, 6 in. under tie; ties, wite oak 6 in. x 8 in. x 8 ft.; spikes, screw and clip; rail, 9-in. 132-lb. groove; joints, Nichols; bonds, none; tie rods, ⅞ in. round 6 ft. c. to c.

CINCINNATI—Concrete, 1:3:7; 6 in. under ties; ties, white oak 6 in. x 8 in. x 8 ft. 2 ft. c. to c.; spikes, R. R. 9/16 x 5½ in.; rail, 9 in. 140-lb. groove; joints, cast welded; bonds, none; rail brace, every 4th tie.

moulds clamped around the abutting rail ends, making the rail to all intents and purposes a continuous one.

Milwaukee uses a rather greater depth of rock under the ties, 6 in. being of coarse material with 2 in. of finer material on top. Rails 95 lb., 7-in. "T" fastened with screw spikes, tie plates and tie rods being also used. Milwaukee is the home of the cast welded joint just described in Minneapolis.

In St. Louis and Cincinnati, Fig. 3, we see two examples of Class B construction, where the ties are entirely surrounded with concrete in one operation. The resiliency acquired in the types we have just seen is not secured in this type; in fact it is quite the opposite extreme; yet the wood ties themselves do absorb a certain amount of vibration that would not be the case were steel ties used. To reconstruct this track it is necessary to excavate right down to the original subgrade. The St. Louis rail is 9 in. deep, weight 132 lb. per yard, and fastened with screw spikes; clips, tie plates, and tie rods being also used. For joints, the Nichols type as already described in Philadelphia.

Cincinnati uses a 9-in. rail, 140 lb. per yard, fastened with railroad spikes and rail braces on every fourth tie, in place

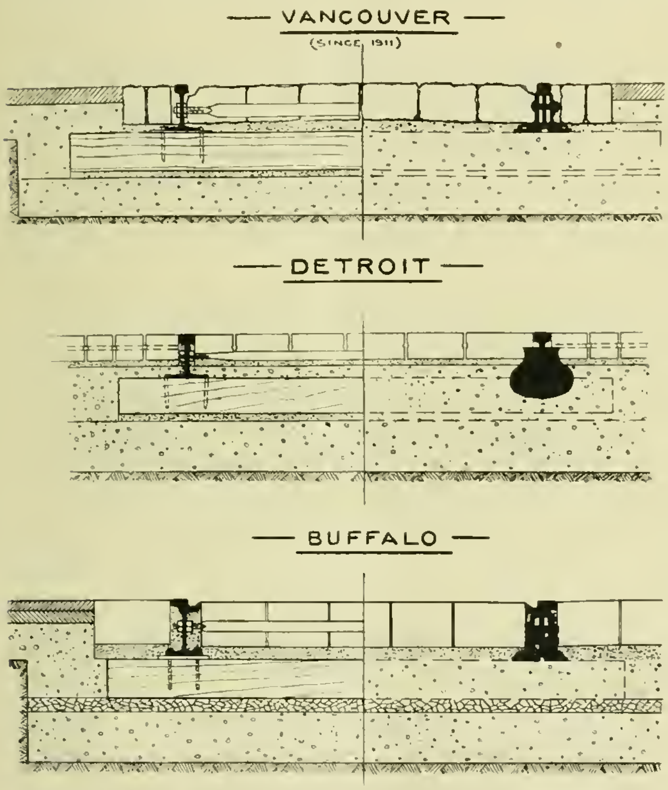


Fig. 4

VANCOUVER (Since 1911)—Concrete, 1:3:6 6 in. under ties; sand cushion 1 in. under ties; ties, fir 6 in. x 8 in. by 8 ft., 2 ft. c. to c.; spikes, R. R. 9 16 in. x 5½ in.; rail, 7-in. 91-lb. Tee; joints, continuous 6-hole; bonds, two 10 in., 7/8 in. terminal soldered; tie rods, 3/8 in. x 2 in., 6 ft. c. to c.; tie plates, 3/8 in. x 8 in. x 9 in. oak or gum on all ties.

DETROIT—Concrete, 1:2:4 8 in. under ties; sand cushion, 1 in. under ties; ties, white oak 6 ins. x 10 ins. x 6 ft. 8 ins. 3 ft. c. to c.; spikes, R. R. 9/16 in. x 5½ ins.; rail, 7-in. 91-lb. Tee; joints, cast welded; bonds, none; tie rods, 3/8 in. x 1½ in. 6 ft. c. to c.

BUFFALO—Concrete, 1:3:5 8 in. under ties; rock cushion 2 in. under ties; ties, pine 6 ins. x 8 ins. x 7 ft., 2 ft. c. to c.; spikes, screw spikes and felter drive screw; rail, 9-in. 124-lb. groove; joints, continuous 8-hole; bonds, one 10-in., one 12-in. comp. terminal; tie rods 5 16 in. x 2 in. 6 ft. c. to c.; tie plates, on each tie.

of tie rods. The cast welded joint is also used, as described in Minneapolis. Attention is drawn to the width of the gauge in these two cities as not being standard.

Both Dallas and Seattle use 7-in., 80 lb. "T" rail, and ties a foot shorter than the popular 8-ft. length, both also use continuous joints. Dallas, however, prefers rail braces every third tie to the use of tie rods, and in addition uses anchors between every other tie. Seattle uses tie rods and no anchors. While speaking of Seattle we might stop a moment to consider a new rail joint that originated some two years ago in that city. This joint will strike you perhaps as something new. The principle sought for in all rail joints is, of course, the elimination of relative motion between the rail ends while still permitting the necessary wave motion for sake of resiliency. This principle has been more scientifically worked out in this case. The top of the angle bar has a slight camber to insure a tight fit under the head of the rail at the immediate rail ends. At the same time the centre at the bottom of the angle bar is undercut to permit of the wave motion, the load applied at the joint is distributed to both ends of the angle bar and thence against the base plate, into the slightly tapered sides of which the bar becomes wedged tighter and tighter as the traffic continues. With this type of joint, bolts are claimed to be unnecessary, but for convenience in putting the joint together are sometimes used. The angle bars are prevented from the unlikely possibility of lifting out of the base plate by an ordinary track spike or lag screw. The base plate fulfils another important function, that of an anti-rail creeper. This is secured by that curved contact between the base plate and the angle bar tending to prevent the longitudinal slip, the base plate also turning down on both sides of the tie. This is the only joint there is time to explain, and as it is one of the latest it should be of interest, since it attempts to solve several problems at once and at present is standing the test satisfactorily. Around Seattle quite a number are already in the track, but as yet we have only one as a sample on our Vancouver system, which was installed last September; it has apparently eliminated the relative motion and is now a good deal tighter than the day we put it in.

Class C. construction. That is the Vancouver type, in which the concrete foundation slab 6 in. to 8 in. deep is first laid on the subgrade, and as soon as it will bear the ties without damage the track is laid upon it with ties spaced 2 ft. centre to centre; this operation completed, the track is rough lined and is then surfaced to grade by wood blocking under the ends of the ties, using factory clippings from lumber mills and No. 2 shingles; the latter, owing to being tapered, admit of very nice work in bringing the track absolutely to grade. Sand is then thrown into the track and tamped under the ties to entirely fill the space between them and the concrete slab. The surplus sand is roughly scraped from between the ties, a final lining up is given, and the track is then ready for the second concrete operation, which concrete is to form part of the paving foundation proper. This, of course, varies in depth according to the city's requirements and the particular type of paving adopted for the street.

The claims for this type of foundation are: First, that the sand cushion on the concrete slab gives the required resiliency secured in the rock ballasted type without the liability of that type to settlement, as the concrete slab readily admits of reinforcement over sewer trenches or bad ground; and second; that it does not make the provision of subdrainage a necessity, since there are no voids, as in the rock ballasted type, to invite water to collect under the track; and, third, the greatest economy of all, the reduced cost of reconstruction from the fact that the concrete slab foundation, being as it were a separate unit, has been placed once and for all and need not be removed. This saving means approximately 20 per cent. of the cost of reconstructing such track. We are indebted to Mr. C. B. Vorce, formerly construction engineer of the British Columbia Electric Railway Company, who in the spring of 1911 laid the first stretch on Granville Street from Hastings to Robson, just four years ago, for the introduction of this type into Vancouver. This type permits advantage being taken also of good hard

ground sometimes met with in cuts to reduce the depth of the slab to 4 in. or 5 in., and similarly to increase its depth to 7 in. to 8 in. over fills of poorer ground. Note the distinct line of separation, Fig. 4, between the concrete slab and what we call the filling concrete. Vancouver and Detroit both use 1 in. of sand cushion, while Buffalo prefers 2 in. of fine rock cushion. Vancouver and Buffalo use continuous joints; Detroit the cast welded joint; Buffalo uses screw spikes, and each of the three uses flat tie rods.

It would not be right to omit mention of an interesting exception to the types shown. San Francisco, using the crushed rock foundation, still further reduces the amount of concrete used by raising the crushed rock between the rails. This city, by the way, had the first cable system; this was installed in 1873.

Regarding the types as used on the new viaducts in Vancouver, that on the Georgia-Harris viaduct is of the all-steel and absolutely rigid type of construction, everything below the base of the rail being concreted solidly in. The legs rest on form boards to support the track, while the concrete, which is also to form a part of the viaduct structure itself, is poured around it. On account of this construction being solidly concreted in, it will be more expensive to reconstruct than in the case where the track is made a unit separate from the bridge structure itself. In the case of the tracks on the Hastings street viaduct, this point was borne in mind, the type adopted is just a slight modification of B. C. E. R. standard type. In this the tracks were made a separate unit and in the construction of the viaduct a track allowance to a depth of 10 in. below top of rail grade, was left to permit of the tracks being laid later. To make the best use of this 10 in. depth, a rail 4¼ in. deep on a steel tie plate ¼ in. thick on a tie 4½ in. deep left 1 in. for our usual sand cushion, steel screw spikes with clips, were used for the first time by us on this work and proved to be a very excellent type of fastening.

Our old method of removing the concrete stringer construction by hand was a somewhat laborious task. The new way, which we do not find nearly so difficult or expensive, entails the use of a Thew steam shovel, which digs up our old concrete stringer construction very satisfactorily without previous breaking up. Some of these pieces were about 7 ft. long, 2 ft. wide and 1 ft. thick, weight about 2,000 lb., and are loaded onto a 3-ton Packard auto truck; this truck has been another great money-saver, doing on an average the work of about four teams. Prior to using the steam shovel on this class of excavation we used a heavy concrete breaker; this was an electric shovel with pile driver leads attached and using a 2,000 lb. hammer. It was a great help at the time, though it is hardly likely that the breaker will be used again, seeing the shovel will excavate the old concrete without previous breaking.

The steam shovel is also used to excavate the brick allowance for ordinary paving work as well as on reconstruction work. Form boards are set immediately behind the shovel, the top of the form board being the top of the concrete slab, which is about to be laid. The use of these form boards helps to construct the slab accurately to grade. The distance between the form boards, or in other words, the width of the track allowance is 18 ft. 6 in. for double track. Where trenches have been cut across for water or sewer work and the steam roller has not been over them, the slab is reinforced, usually with expanded metal lath to guard against settlement. The practice of building up deep fills in layers as laid with a steam roller is believed to give more uniform and better results than that of puddling a fill, since uniform puddling is very hard to secure and results often in soft spots, which in many soils refuse for a long time to dry out. In the one case you know what you have got and in the other there is considerable uncertainty. The original temporary track is thrown over to the side of the road, but sufficiently close to the new track allowance to permit of material for the concrete to be delivered to the excavation from steel 5-yd. side dump Koppel cars by work trains operating between the bunkers and the job.

The navvy-jack gravel is delivered ahead of the mixer which is laying the concrete slab. The concrete is in proportion of one of Portland cement, which is required to pass standard specifications, to nine parts of navvy-jack gravel, which must consist of two-thirds gravel and one-third sand; this gravel may be pit run, but fresh water gravel is cleaner. The proportions of one-third sand and two-thirds gravel are insisted upon and a sample is tested on the ground from every five yards delivered. If the proportion varies more than three per cent. either way additional material is delivered to correct the deficiency.

In Vancouver we use a second concrete mixer running on the rails and filling in the newly laid track. This type of mixer is well suited to this type of work; there are no

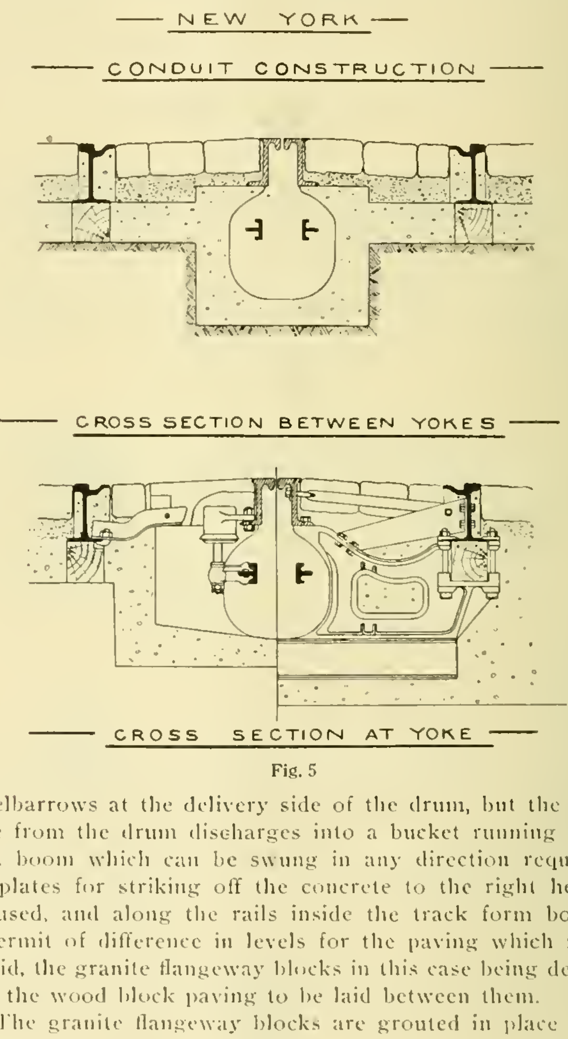


Fig. 5

wheelbarrows at the delivery side of the drum, but the concrete from the drum discharges into a bucket running on a 30-ft. boom which can be swung in any direction required. Templates for striking off the concrete to the right height are used, and along the rails inside the track form boards to permit of difference in levels for the paving which is to be laid, the granite flangeway blocks in this case being deeper than the wood block paving to be laid between them.

The granite flangeway blocks are grouted in place with two to one sand and cement, prior to laying the wood block paving.

It would not be right to close without reference to the material used for special work at junction points, though this is a large subject in itself and difficult to touch lightly upon. The installation of the junction at Main and Hastings streets was completed in 1912. The new steel for this junction cost $13,700. There are four types of special work construction, but there is only time to go into two, however, for purposes of comparison. These are commonly known as manganese insert construction and solid manganese construction. The previous layout was installed in 1904, and was getting into bad shape some six years later, but

with considerable tinkering we managed to keep it in the ground for two years more. The switches, frogs and crossings were of the manganese insert iron-bound type of construction; that is, a plate of manganese steel is inserted at the point of greatest wear, which, of course, is the point of intersection of the two rail heads. The plate was bedded on spelter and keyed down, the arms, which are short pieces of rolled rail of the required section, are set in place in a mould and then cast-iron is poured around them to hold them fast. Special work built in this way has unfortunately been prolific of much trouble in comparison with the solid manganese type. Attention is drawn to the number of different parts that go to make up a crossing. There are the four arms, the manganese insert, the keys which fasten it down and the cast-iron body—we might say seven pieces at least. Then look at the different metals used in its make-up—open hearth steel rails, manganese steel insert, zinc spelter bed for the insert, and cast-iron body—four different types of metals and two of these are in direct contact with the rolling load, namely, the insert and the rails and through them the load is transmitted to the spelter bed and the cast-iron body; could one reasonably expect uniform results from such a miscellaneous collection? This point is worthy of attention, because most street railways on this continent are suffering from this very complaint.

One has only to compare the results of wear on manganese steel and wear on open hearth steel to answer that question. Tests have proved that wear on open hearth steel is about seventy times as rapid as on manganese steel, so that the insertion of a piece of manganese steel between two pieces of open hearth steel defeats its own object, and in endeavoring to eliminate excess of wear at one point it creates uneven wear at four others, namely, on all dies of the insert where the two steels join. This often results in damaging the crossing permanently by breaking the arms loose in the casting. Another mechanical fault, and surely it was one, was to set the insert on a spelter bed. The insert's object is to eliminate wear and it should therefore be provided with an absolutely solid foundation. This can only be secured by machining the surface of the cast-iron body and the underside of the insert and by bolting it down. The fault with the spelter was, of course, that, comparatively, it was a soft metal and unable to withstand the shock or impact of the passing load without flowing and it consequently quickly permitted the insert to work loose. Some cities have so much of this type of special work as to make it necessary to have a track gang doing nothing but re-setting loose inserts, and since every manufacturer has a different method of fastening the inserts, considerable experience is necessary to make such repairs with rapidity and economy. In comparison let us consider for a moment the Vancouver junction, which shows the solid manganese steel type of special work which was used when renewing this special work junction in 1912. Each insert crossing was made up of seven or more pieces, each crossing in this case in one single piece. The insert type combined the use of three types of steel as well as spelter; in the type before us solid manganese steel alone is used. Solid manganese special work was adopted for junctions in Vancouver as far back as 1907 and is now standard for our heavy traffic junctions, and has given eminent satisfaction. While for plain rails solid manganese is only used where very heavy traffic is to be catered for, such as around the library corner, solid manganese has not been used entirely for all plain rails on our special work throughout, as it is believed that this would be going to unnecessary expense. The plain rails, therefore, are usually of open hearth steel, and while it is admitted that uneven wear will in time show up where the manganese steel joins the open hearth steel, yet these places are not so close together as in the case of insert work, nor does such wear have any damaging effect upon the crossing.

An appliance has recently been invented whereby new steel can be electrically welded onto worn rail surfaces. Street railway companies on every continent were just looking for some such appliance, and its possibilities in repairing special work and in postponing re-construction on account of bad rail joints has given this appliance a most enthusiastic reception.

It is only fair to say that probably no track ever invented has ever saved street railway companies more dollars than the Electric Arc Welder. Much track which would otherwise have been scrapped has by the use of this welder been given a new lease of life.

Mr. Rothery Victim of Heart Disease

As we go to press we learn with deep regret of the death of Mr. J. C. Rothery, manager of the Toronto & Eastern Railway Company, one of the subsidiaries of the Canadian Northern Railway System. Death was due to heart failure. Mr. Rothery was one of the best known electric railway men on the continent. His first practical experience in railway construction was in the building of the Gorge Railway between Niagara Falls and Lewiston, at which time he was superintendent of construction. Later he was appointed manager of the line, and when the Niagara Falls Park and River

The Late Mr. Rothery.

Railway merged with the International Railway of Buffalo, he was made general manager of the system. Some years later Mr. Rothery resigned his position to become general manager of an electric railway system in East Liverpool, Ohio, coming to Toronto some seven years ago to superintend the planning and construction of the Toronto and Eastern Railway System for the Canadian Northern Railway. Mr. Rothery was a prominent mason and club man, being one of the oldest members of the Victoria and Albany Clubs of Toronto. He was also a life member of the Niagara Falls, N.Y., Club. He was known as one of the most expert divers and swimmers in Canada, and is said to have been the only man who ever dived from the International Bridge at Lewiston into the Niagara River.

At a recent meeting of the district council held at Mission City, it was decided that a number of municipalities should act in conjunction and approach the Western Canada Power Company with a view to getting work started on the proposed tram line along the north shore of the Fraser River, for which the company holds a franchise.

The Dealer and Contractor

Estimating—A Scarcity of Competent Estimators

By C. R. Kreider

One of the most difficult problems confronting our business is the scarcity of really competent estimators. The position of estimator is also one of the most trying jobs imaginable. If the bids are too high and the work is not secured the estimator gets the blame. If the bid is too low and you get the job and lose money he is cussed because he figured too low.

The ideal estimator would of course be one who had the happy faculty of always figuring correctly, but even granting that such an ideal is with us, his skill would often be wasted because some one of his competitors would spoil his chances for securing the work by putting in a figure far below the proper one, due to ignorance of costs and poor estimating. You frequently hear the expression that the man who makes the most mistakes gets the most jobs. Is this really the case? I fear that there is more truth than poetry in this statement. How, then, are we to correct this condition in our business?

I believe I can state without fear of contradiction that too little attention has been paid to the development of competent estimators. It has always seemed strange to me that business concerns did not pay more attention to this, the most important part of their business.

It has been the most common practice to promote men from the ranks of workmen to the post of estimator on the theory that a practical workman was necessary to properly estimate the cost of work. While I am a firm believer in rewarding merit by promotion, I am also of the opinion that the average practical workman seldom has the essential qualifications for the detail work which falls on the shoulders of the estimator. While a practical knowledge of the construction business is of course important and a necessary qualification for an estimator, I do not agree with the idea that it is necessary for a man to have actually engaged in the trade as a mechanic in order to be a skilful estimator.

The man who has risen from the ranks of mechanic to that of estimator is prone to make the mistake of basing his calculations on his own ability as a former mechanic, rather than on the cold stern facts of figures covering similar work done in the past and where the law of averages has to be reckoned with.

We hear and have been hearing for a long time past a great deal about the necessity of the contractor keeping suitable books of account so that he may know where he stands financially. The National Electrical Contractors' Association has done a great work in making its membership see the value of this advice and has developed a system of accounts which is simple and at the same time gives the results desired. Among the other things incorporated in this system is a cost system, so that the contractor may see just what each job costs.

We will admit, for sake of argument, that the contractor has a properly kept set of books and knows what each job costs. So far, so good. If, however, he does not make constant and careful analysis of these cost records they will avail him little as a source of information on which to base future bids. The average estimator is too apt to follow certain rules of thumb in making up his estimates, rather than considering each job on its own peculiar merits.

Keeping accurate cost accounts will also yield but little practical and useful data unless the information is in such form that it can be dissected and reduced to units to serve as a guide to calculating future costs. It is right here that the estimator must keep in close touch with the accounting department. It is the estimator who must also be in close touch with the sales department, the purchasing department, the drafting room and the outside superintendent.

Too often the estimator is not allowed sufficient latitude and as a result the work does not go in as figured and he gets the blame for something over which he had no control.

The estimator must, in order to be a success, be a versatile man. He must be rapid, yet accurate and painstaking; be posted on the rules and regulations governing electrical work; be able to read plans and understand them; be familiar with the different classes and systems of buildings; be posted on the latest developments of the electrical field; know thoroughly the different brands and grades of goods and their costs, and preferably should have a technical education, so that he can readily grasp the details of the scheme covered by the specifications he is figuring on and be able to determine the practical and most economical way to accomplish the object sought and be able to say with confidence that the scheme proposed is not practical and will not work satisfactorily, should this be the case.

Diversity of Work

If all of our work were of one kind or class the problem of estimating would be a much simpler process than it really is. To-day the estimator may be figuring an office building of fireproof construction; to-morrow a combination light and power job in a mill constructed building, and next day a church, school, flat building or residence.

With the rapid increase in the use of iron conduit for all classes of work, both open and concealed, the estimator of yesterday who has been used to figuring open cleat or knob and tube work finds himself often treading on unfamiliar ground in being called on to prepare an estimate for a conduit job. He must, as I have previously stated, be a versatile man and be prepared to handle new problems with a confidence born of a knowledge of cost units which will enable him to prepare an estimate which will be intelligent and correct.

The estimator should make it a rule to get out on the work as it is being installed as much as possible, because it is there he will see the things that frequently do not show on the plans and make it possible to avoid like errors in the future.

The estimator is the life or death of the company with whom he is connected. His pay should be commensurate with his responsibilities. How often, however, do we find this position held by the most incompetent of men. The

Read before The Electrical Contractors' Association of Wisconsin.

contractor is backing his hard earned money against the opinion or judgment of his estimator, and one would naturally assume he would be most particular in his choice in this direction.

In certain classes of work the number of lights or outlets makes a check on the accuracy of the estimator's bid a fairly simple matter. In the more desirable contracts, however, where the work runs into large figures, the special features involved require more than an off-hand opinion on the cost problem. The matter of arriving at an accurate schedule of the materials required is not the difficult part of preparing an estimate. It is the labor which is the bug bear which causes a great many of us to lie awake nights. With the many refinements and fittings being constantly developed, and their relation to the labor required, the study of the labor units is one which every contractor who expects to succeed in our line must realize.

Need of a School

Unfortunately there is no school for electrical estimators, and the need therefor is a pressing one. The matter was taken up a short time ago by the National Association, and I hope some plan can be developed whereby the estimator who wishes to rise in his profession or the man who wishes to become qualified in this line will have facilities placed at his disposal whereby he may perfect himself.

By a great many the task of estimating is looked upon as a necessary evil, and one to be gotten over with as soon as possible. It is hard to get and keep a competent estimator, and the financial remuneration is such that there is little inducement for a man to qualify. Being the most important position in a concern, the pay should be made attractive, so that competent men will be seeking these positions rather than one where the responsibility is less but the pay greater.

The tendency in estimating labor has been too much in the direction of sizing the job up in a general way and putting down a lump sum which does not lend itself to intelligent analysis.

The modern and progressive estimator no longer does this. Instead, he uses units of labor for each item of material to be installed, and thus is enabled to get a more accurate estimate than could possibly be arrived at in the previously mentioned haphazard lump guess, for guess it really is, when you lump your labor and do not detail it with respect to the different items of material to be installed.

The National Association has recently brought out a universal estimating sheet, which is so arranged that the labor can be extended directly opposite each item of material. There is also printed at the left hand margin a list of reminders. In reading through the specifications, the different items which will be required should have a check mark placed opposite same. When the different items are finally assembled on the estimate sheet a check back against the reminder column will guard against leaving anything out of the material list. This estimating sheet I consider fills a long-felt want, and is supplied by the National Association at 80 cents per 100 sheets, which is cheaper than you can have your local printer print up a form which does not have these safeguards. For the benefit of those who are not familiar with this form of estimate sheet I have brought along a supply and will be glad to give a sample to anyone who may be interested. The more universally these sheets are used by our membership the greater the tendency to uniformity in preparing bids.

One of the greatest evils the estimator encounters is the small amount of time allowed to prepare his estimate and get in his bid. This is a matter which can be corrected in a large degree by the local contractors co-operating with each other and declining to submit tenders where a reasonable time is not allowed. Architects and engineers are prone to get out about two sets of plans and specifications and expect eight or ten bids to be prepared in 48 hours. Manifestly, no estimator can do himself or his company justice under such conditions. A firm stand by the contractors to decline to bid unless a reasonable amount of time is allowed would go a long way to improve conditions in this direction. Estimates prepared hastily are not likely to be accurate, and I have always taken the stand that unless the architect or engineer was willing to permit sufficient time to prepare a proper estimate my firm did not care to submit a bid.

The environment of the estimator is an important matter. He should have a room to himself where he can lock himself in if necessary and where he can be quiet and undisturbed. The room should be cheerful and well lighted, and provided with one or more large tables, so that there will be ample room to spread out his plans. An ample catalogue file should be located in this room and kept up to date and properly indexed, so that instant reference can be had to any desired article.

The estimator should be provided with an adding machine, on which he can set down his measurements and quantities as he goes along, and also for checking the footings on his estimate sheets. In order to relieve him of a large amount of merely clerical work the extensions of the various units and items, after being priced by him, can just as well be done by the bookkeeper or other regular clerical help. The estimator is usually, in normal times, working under pressure, because his firm wishes naturally to get in bids on as many jobs as possible. I have often felt that one of the greatest mistakes in our line of business was the attempt to get in a bid on every job which came along. I have always felt that quality instead of quantity should have more consideration.

No one concern can get all the business, and as it stands to reason that an estimate hastily prepared is more likely to be wrong (it may be too high as well as too low) one does not have the confidence in such an estimate as compared with one which has had the proper amount of time spent on its preparation.

When more plans are offered than you can properly figure choose the most desirable ones and pass the others by.

Another custom which is unfair to the estimator is the practice of certain engineers and architects requiring plans to be figured in their office. You all know this game. There are six or seven others in the architect's office at the same time, each taking a grab at the plans. You will have to admit that in our line of work it is impossible to prepare a proper estimate under these conditions.

Don't figure in the dark

The contractors can here again correct this evil by declining to submit bids unless they be allowed to take the plans and specifications to their own office to figure.

I know a great many of you will say that it cannot be done, but I know that it can. For many years past I have uniformly refused to figure any job unless the plans and specifications are allowed to be brought to the office where they can be estimated under proper conditions, and I have found few cases where a firm stand in this direction has met with refusal. A proper placing of the facts to the Architect or Engineer will show him how unfair it is to expect a man to properly figure plans and digest specifications in the outside public office where there are no facilities to work with and where there is so much going on to distract the mind that it is impossible to think clearly. A determined stand in a co-operative way will eliminate this condition. Personally, **I prefer not to bid at all unless the estimating can be done under proper conditions and sufficient time is given to properly prepare an estimate.**

In the few cases where this is refused I feel that my concern is better off not to file a bid.

I have spoken previously of the too common practice of lump labor estimating and I want to go back again to this point. The larger number of parts into which you can sub-

divide your labor the simpler and more accurate will be the calculation of the labor, and by the use of the Universal estimating sheet issued by the National Association where the labor is opposite each material item it reduces the omission of labor to a minimum and also makes it a simple matter for the manager or proprietor to go over the estimate and check the labor with a degree of satisfaction that would otherwise be impossible.

I also wish to refer again to the matter of subdividing estimates: By this I mean where there is for instance both light and power, make a separate estimate of each and do the same for other special features such as bells, telephones, signal systems, etc. By doing this you get the total value of each component part by itself and are in a better position to survey the accuracy of the work than where it is all dumped into one general pot.

You have sometimes heard a contractor refer to a job he had completed and waxing enthusiastic because it had cost a great deal less for material or labor than he had figured. The reasons may be perfectly legitimate and then again they may not. These cases should be analysed as carefully as the cases where the reverse is true, because it may lead to the error of figuring too little labor or material on the next job where conditions are not so favorable.

The estimator should be kept regularly informed as to the cost of all his jobs as they progress, especially with reference to the labor and should be supplied with a simple system which will be accessible and not entail too much work to keep it up.

A Simple Card System

My own scheme in keeping my estimating department informed as to labor is to use a 3 x 5 index card specially printed and ruled for the purpose. On the front of the card is the name of the job, the selling price and the estimated material and labor. On the back are ruled columns for the labor. Each week as soon as the payroll is made up the bookkeeper makes out a memorandum of the labor expended on each job during the week and gives it to the estimator who takes out the cards of the jobs given on the memorandum and enters the amount on the back of the card with the date and brings down each week the footing of the total labor to date. In this manner the total labor on each active job is brought to the attention of the estimator each week. As he naturally is in touch with the superintendent daily and knows in a general way the general percentage of completion this weekly report keeps him automatically posted as to how the various jobs are running. It will be noted that where work is not progressing on certain jobs there is of course no labor for that week and consequently only the ones on which labor has been spent during the week come to his notice, as there is no need to bother with the cards on the inactive jobs. If, however, it is desired to look up a job on which work is not going ahead at the time, the card for that job is found in the file and the total labor to the last active date ascertained instantly. This is only a memorandum card and has no bearing on the cost ledger, but the object I have accomplished is to afford a simple and automatic means for bringing the condition of the labor each week on each active job to the attention of the estimator immediately after the payroll is made up and without having to wait for the bookkeeper to post up his cost ledger. Before these cards are placed back in the file each week I have them brought to my desk so that I can also keep in touch with the active jobs each week.

The estimator should be provided with a file, preferably vertical file, using manilla folders and preferably 10 inches by 15 inches sizes for filing his estimates. The most convenient method is to number the folders consecutively and call this the estimate number which number should appear on the proposal for purpose of identification and reference. In the

SOLD TO .... Shop Order No. ....

Date Entered .... Date Billed .... Selling Price ....

Salesman .... Estimated ....

Estimate No. .... Estimated Profit .... Actual Profit ....

Contract .... Time and Material .... Cost Sheet ....

Transferred from Original S. O. No. ....

Department ....

Est. Material .... Description ....

Est. Labor ....

Est. Total Cost ....

(Front of Card)

LABOR RECORD

For Week Ending	Pay Roll No.	Amount	For Week Ending	Pay Roll No.	Amount

(Back of Card)

folder are filed all papers pertaining to the estimate, any special quotations received for same and a copy of the proposal; also copy of the specifications or such extracts as you wish to keep. I mention the 10 inches by 15 inches size because this will take legal cap size paper, on which most specifications are written, without folding.

In my office I use two colors of folders. The white folder is used when the estimate is made and filed away. Should an order result the estimate is transferred to a pink folder, given the same number and filed in another drawer. In this manner when you wish to destroy back files you do not destroy the estimates covering contracts secured, as these should be preserved for future reference.

A duplicate copy of each sales ticket is made for the estimating department and this is filed with the estimate. In this manner without any extra work or red tape the estimator is at all times in touch with the operating department. There must be the fullest co-operation between the estimating department and the outside superintendent. Without this you cannot expect to get satisfactory results.

The collecting and study of these units is a most interesting, instructive and valuable educational pursuit, and I hope that more of our contractors will take up the subject seriously and get in the habit of reducing their labor to these small units which will do much to remove the uncertainty of the old slipshod lump guess of the past.

There is unfortunately no golden rule which will absolutely prevent errors. Judgment must of course be exercised in handling any class of figures, but I can say to you gentlemen that if any of you are not estimating your labor in itemized unit form the sooner you start the better off you will be financially and you will find yourselves in the position of having confidence in your estimates, because they will be more accurate and where the competition is keen and work must often be taken on close margins you can better judge just how far you can go and know when to turn down an unprofitable job.

Mr. Shields Head of Separate Department

The Board of Control have consented to the separation of the Electrical Inspection Department from the Architect's Department. Mr. Shields, the chief electrical inspector recently appointed, will therefore carry on the operation of this department entirely independently. Mr. Shields has already made a good start by electing a number of competent inspectors. These are Messrs. C. H. Smart, first assistant; W. J. Bate, second assistant; P. T. Gaston, third assistant; W. A. Butchart, fourth assistant. Further appointments will be made in the near future.

The Wiring of Old Houses—A Big Field That Has Scarcely Been Touched

The war and the general business depression which preceded it have undoubtedly influenced the business of the electrical dealer and contractor in so far as it refers to new buildings. Statistics show that there has been a very considerable falling off in the building trades. The wiring of new buildings and the supply of equipment thereto has, however, occupied an unjustifiably prominent position in the mind of the dealer and contractor during the past. In like proportion the field of unwired finished houses has been under-estimated. In this connection much excellent work in the way of collecting statistics on the percentages of people using electricity in towns of various sizes has been performed by the National Electric Light Association of the United States and similar organizations, and a very excellent book which treats of the wiring of finished buildings, by Terrell Croft, is just off the press. This book is, in our estimation, the most important publication from the electrical contractor's viewpoint that has made its appearance. If nothing else it has pointed out the tremendous proportions of the business possibilities in the wiring of finished buildings, though it has done much more than this and by very excellent illustrations and lucid explanations has portrayed the most approved methods of overcoming the difficulties met with in this class of work.

Mr. Croft's statements with regard to statistical information available with reference to finished buildings not equipped with electric wiring and appliances, are sufficiently definite to open our eyes to the fact that, as a profession, the electrical contractors have been neglecting a large and profitable field. His figures apply largely to towns and cities in the United States, though in certain cases Canadian towns were included. The statement is made that in different sections of the country, the number of central station customers ranges from a minimum of 20 to a maximum of 200 per 1,000 of population, with an average around 50 or 60. It is pointed out that in Strassburg, Germany, and in Milan, Italy, the development has reached a value of over 150 customers per 1,000 population, which goes to show that we are a long way from the limit to which this field might profitably be developed.

Speaking again of the percentage of houses wired, the statement is made that figures available covering various sections of the North American continent indicate that 58 per cent. only of the houses are wired, the average being taken from 100 towns of a population of 5,000 or less. In towns with a population ranging from 5,000 to 10,000 the percentage is 54. In thirty-two cities with populations between 10,000 and 20,000 the percentage runs as high as 60, and in newer sections of the country it is considerably higher than this. These figures are, of course, based on incomplete returns, and it is judged that, if complete returns were available, the percentage would be considerably lower.

It is pointed out that, in a number of cities, illuminating gas customers reach as high as 250 per 1,000 population, and there is no apparent reason why the electrical development should not at least equal this, and indeed exceed it. This being the case, any town where there are not at least 200 customers per 1,000 population has splendid possibilities ahead of it for the central station contractor and the dealer. One authority is quoted as estimating that, considering the entire country, only about 8 per cent. of all houses are equipped for electricity.

The foregoing remarks, based on authoritative and more or less complete statistics, indicate very definitely the line along which electrical contractors should be operating in Canada to-day. It is probable that, in many of our towns, from 50 to 75 per cent. of the houses are not wired. This is a good time to start an advertising campaign. Electric current is getting cheaper; electrical appliances are getting cheaper; labor is more abundant. We believe the contractor who makes a special study of this field at the present time will obtain results quite beyond his expectations. Incidentally he will do well to equip himself with a good book such as that from which we have quoted. It is published by the McGraw-Hill Book Company, Inc., New York, and may be obtained through this office.

Winnipeg Jovians Make Merry

The Jovians of Winnipeg have just carried to a successful conclusion their first annual Bonspiel, which took place in the Granite Rink, play starting Monday, March 1st and finishing on March 3rd. Sixty-four players participated in the event.

A list of the active Jovians was taken from which sixteen skips were selected, the selection being made with a view to placing at the head of each rink a skip having some experience with the game and consequently better able to guide his rink and make the play more interesting. It was left in the hands of the different skips to select their own rinks, the committee thinking this would be a much better scheme than making the selection themselves, for, by a skip selecting his own men he could surround himself with players with whom he was acquainted and in that way make the whole event more congenial.

There were two events in this Bonspiel, the Challenge and the Consolation. For the Challenge Event, Mr. C. S. Shipman, of the Shipman Electric Company, donated a very handsome cup which is to be played for annually, the cup not passing into the permanent posession of the winning rink, but instead a small silver shield suitably engraved with the names of the winning rink will be placed on the ebony base. This cup will be held by the winning rink for one year. To go with this cup, Mr. H. W. Billing, of the Northern Electric Company, donated four very handsome pins as individual prizes for the rink winning this event.

The play in this event was very closely contested all the way through, the semi-finals and finals being very close games and particularly fitting for final games, the play all the way through being keen and the score very small indicating how evenly matched the different rinks were.

Mr. M. H. Farnsworth, of the H. W. Johns-Manville Company, was successful in winning this event, but not, however, without playing a very hard game with A. W. Lamont of the Canadian Westinghouse Company, this game not being decided until the last stone was thrown. Farnsworth proved to be a little too much for Lamont, and to him and the individual players on his rink, the Jovians as a whole extend their hearty congratulations.

The play in the Consolation Event was also closely contested, and the finals in this game between Mr. L. B. Dickson, of the McDonald-Wilson Lighting Company, and Mr. J. W. Sanger, of the Siemens Company of Canada, brought out some exceptionally brilliant work, it being anybody's game until the last stone was thrown. Dickson, however, proved too much for his opponent, and Sanger had to be satisfied with the small end of the score.

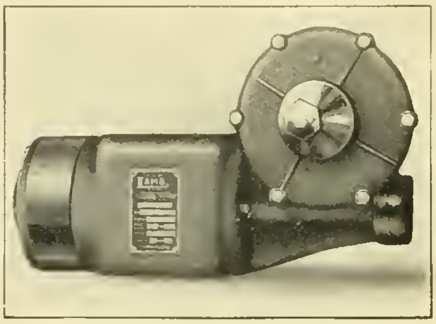
The Winnipeg Jovians also extend to Mr. Dickson their hearty congratulations in winning this event, which carries with it a cup and four individual prizes.

It is intended to make this Jovian Bonspiel an annual affair, and all the Jovians are looking forward to staging a much larger Bonspiel next year. We are indebted to Mr. Skinner, of W. E. Skinner, Limited, for the above information.

What is New in Electrical Appliances

An Electric Starter for Every Automobile

The illustration herewith represents the Lamb electric starter for use on motor cars not originally equipped with this convenience. This starter can be installed on any type of car and is guaranteed to crank any engine and spin it many times faster than could be effected manually. The motor is placed in front of the car and is connected to the crank shaft by a worm gear reduction. The motor itself is driven from a storage battery, contact being made simply by

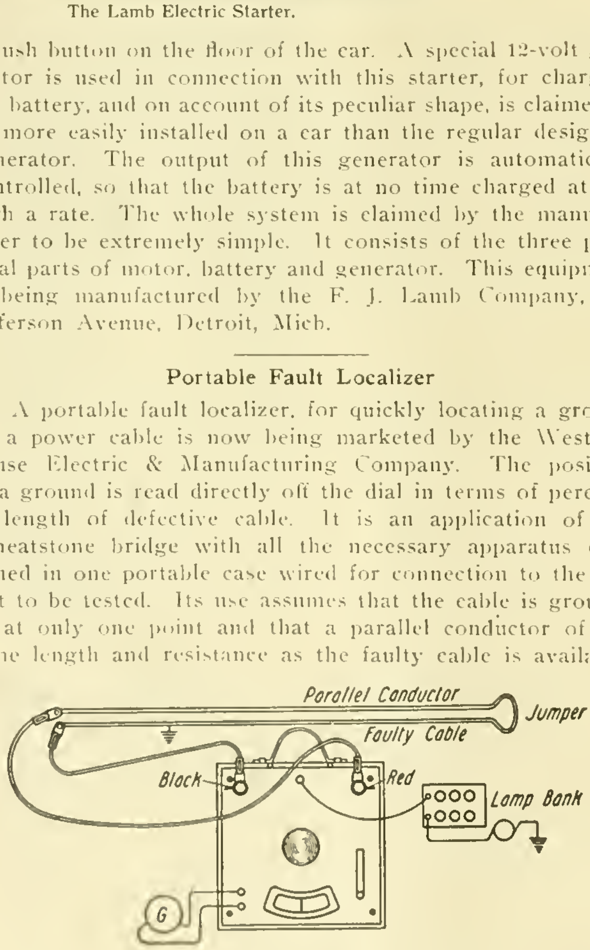


The Lamb Electric Starter.

a push button on the floor of the car. A special 12-volt generator is used in connection with this starter, for charging the battery, and on account of its peculiar shape, is claimed to be more easily installed on a car than the regular design of generator. The output of this generator is automatically controlled, so that the battery is at no time charged at too high a rate. The whole system is claimed by the manufacturer to be extremely simple. It consists of the three principal parts of motor, battery and generator. This equipment is being manufactured by the F. J. Lamb Company, 940 Jefferson Avenue, Detroit, Mich.

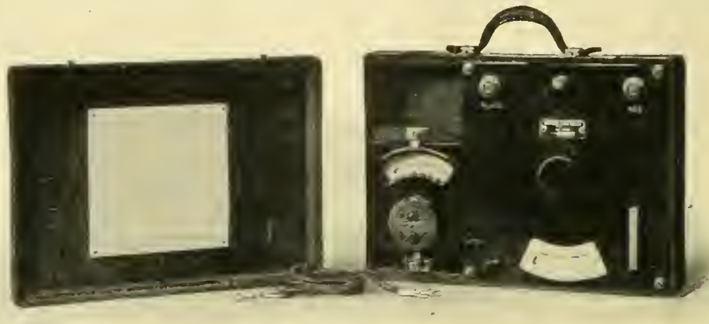
Portable Fault Localizer

A portable fault localizer, for quickly locating a ground on a power cable is now being marketed by the Westinghouse Electric & Manufacturing Company. The position of a ground is read directly off the dial in terms of percent. of length of defective cable. It is an application of the Wheatstone bridge with all the necessary apparatus contained in one portable case wired for connection to the circuit to be tested. Its use assumes that the cable is grounded at only one point and that a parallel conductor of the same length and resistance as the faulty cable is available.



Plan of Fault Localizer.

After proper connections are made, a dial on the instrument is revolved by means of a knob in the middle of the localizer until the galvanometer shows no deflection when the key is closed. The reading of the meter then gives the percentage of length of the feeder from the point where the test is being made to the location of the ground, assuming the total length of the feeder to be 100 per cent.; the red scale indicating that the ground is on the conductor connected to the binding post marked red, and the black scale indicating to the binding post marked black. Direct current only is used in these tests. The fault localizer consists of a polished wooden case which contains all the parts necessary for the test except the source of direct-current supply and the leads to the cables. Two styles are furnished, one containing a



Portable Fault Localizer.

galvanometer and the other for use with a separate galvanometer. The variable resistance arms consist of two loops of low resistance wire attached to the side of the revolving disc, upon which the dial is attached, so that contact is easily made from two brushes attached to the case and connected to the galvanometer terminals. As the disc is revolved the point of contact between the brushes and the resistance loops is thus varied, as in the slide-wire bridge. The dial is calibrated in percentage of the length of the conductor tested, so that the reading is direct. The galvanometer is highly sensitive, having a "uni-pivot" bearing, which does not have to be levelled to take readings. It can be used for general testing wherever a portable galvanometer of its sensibility is desirable, and can easily be removed from the case when this is desired. It has a resistance of 5 ohms, full scale reading .00036 ampere, and sensibility .00001 ampere division.

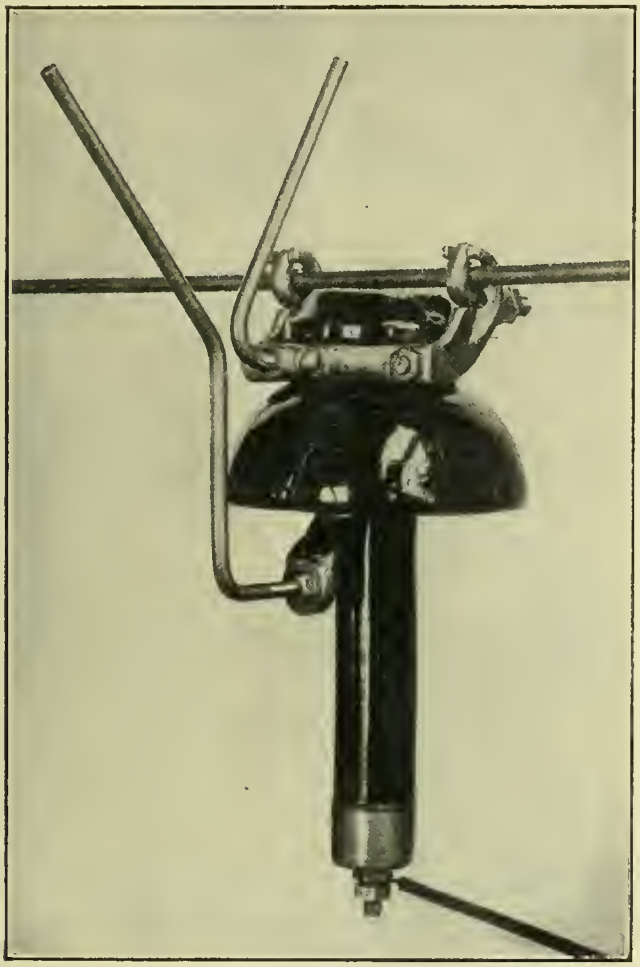
Samples of Renewable Fuses

The Economy Fuse & Manufacturing Company of Canada, Limited, Unity Building, Montreal, are distributing samples of their renewable fuse. The use of renewable fuses is growing in popularity on account of the saving in replacing charges, and the Economy type is one of the best. With each fuse the company supply two extra renewals and when these are used up, new ones can be purchased for from 2 cents up, depending on the size. The company are also distributing some informing literature in the form of booklets entitled, "Economy Renewable Cartridge Fuses." The Economy Fuse Company claim that by using their fuses, 80 per cent. of fuse cost is saved over the old non-refillable type. The time taken to refill a fuse is negligible and the operation so simple that the least experienced operator can easily handle it.

The Canadian Westinghouse Company have declared a quarterly dividend of 1 per cent. for the first three months of 1915. This compares with $1\frac{3}{4}$ per cent. for the same period a year ago.

Burke Suspension Type Lightning Arresters

The accompanying cut pictures a new lightning arrester for 2,200 and 6,600 volt service recently placed on the market by the Railway and Industrial Engineering Company, of Pittsburgh, Pa. It is known as the Burke Suspension Type Lightning Arrester and consists of an adjustable horn gap with a resistance in series with the ground circuit. The arrester can

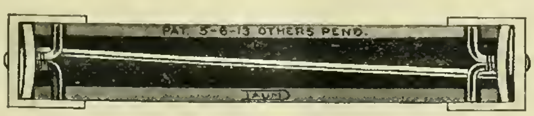


Suspension type arrester.

be suspended direct from the transmission line; it is not necessary to cut the line, and no mounting is required. All metal parts are of brass. Koppat resistance is used in the ground circuit to limit the flow of dynamic current which might otherwise result if two or more phases discharged simultaneously. The arrester can be used on circuits of any capacity.

Daum Refillable Fuse

The illustration herewith represents the latest type of Daum refillable cartridge fuse shells for electric light and power. This is their type B fuse, which has been improved



Type B refillable fuse.

by slightly dishing the metal bar threaded on the cotter, thereby preventing the fuse wire from being cut. All Daum fuses are in accordance with the rulings of the National Board of Fire Underwriters.

EverReady Fountain Pen Light

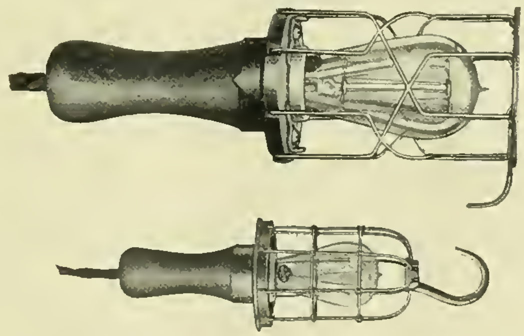
A new type of flashlight, exactly like a "banker's" fountain pen in size and appearance, has just been announced by the Canadian Ever Ready Works, 90 Chestnut Street, Toronto, Ont. This fountain pen light has several important and exclusive features. The light can be either flashed, or burned continuously, as desired and laid down while burning, so that both hands are free to work. The tungsten battery for this

Just fits your vest pocket.

light has been designed and made with special care and only the very highest grade of materials is used in it. Its life, as shown by tests, is claimed to be longer than any of the other similar-sized batteries on the market and is fully guaranteed. The fountain pen light is 5¾ inches long, ¾-inch in diameter, and weighs only 1½ ozs. It has a clip so that it con be securely carried in the vest pocket, without inconvenience.

Guards for Portable Lamps

Two types of non-detachable guards for portable lamps are shown in the accompanying illustrations, that illustrated in Fig. 1 being equipped with an open end and that in Fig. 2 with a closed end. The open-end guard is designed chiefly for pit work. In the closed-end guard the end piece is hinged to the cage by means of a rivet to allow for replacement of the lamp. A thumb nut is employed to hold the end piece fast. The open-end guard is equipped with a side hook as



Two types of non-detachable guards.

shown in the illustration. The cage is of steel and the wires are electrically welded. The closed-end guard is 15 ins. long, including hook and handle, and weighs approximately 25 ounces. The open-end lamp guard is 10 ins. long over all, including handle, and weighs 20 ounces. Both guards are substantial in construction and are designed for use with circuits, with pressures up to 600 volts. The guards are being placed on the market by the Electric Service Supplies Company, Philadelphia, Pa.

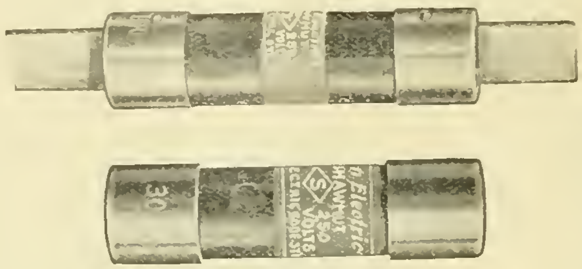
Collecting Accounts by Telephone

Some accounts can be collected quite readily by calling the customer up on the telephone, especially if he be the user of a rural line. A customer on a party line will not take any chance of his neighbor hearing him being asked for payment of his debts, and most rural customers will immediately make some arrangements about payment rather than have this repeated.

The Western Electric Company, Limited, has been incorporated with capital of $10,000, and head office in Vancouver.

Shawmut Fuses

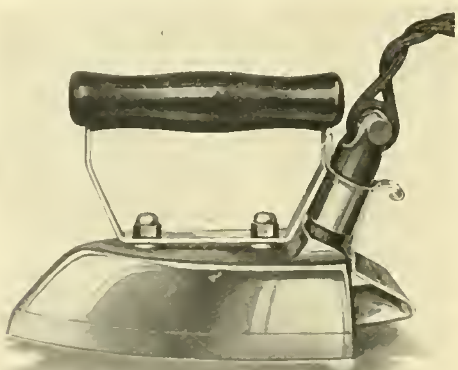
The National Electric Code standard fuses of to-day are made up in two types, the ferrule and knife blade form of contact. Fuses up to and including 60 amp. are of the ferrule contact, while above this capacity, knife blade contact is used. On all Northern Electric Shawmut ferrule contact fuses, drawn copper ferrules are used to give maximum conductivity, obviating objectional heating under all conditions. This feature, coupled with the black fibre tubing, provides close regulation from an electrical standpoint, and at the same time affords a fuse of good external appearance. On panel boards or switchboards this copper and black finish



shows to best advantage. The internal construction of Shawmut fuses has been carefully developed, especially with reference to the shape, area and volume of the link which has been so designed that a minimum amount of heat is given to the insulator container while at the same time perfect operation is insured on short circuit. Careful tests have shown that with a given shape and size of the fusible element variations in condition of the filler causes a marked change in the carrying capacity of the fuse. Shawmut fuses also include an indicator that is positive and reliable in operation. The red target in position shows a perfect fuse, but when displaced indicates the fact that the fuse has operated to open the circuit.

Two New Electric Irons

The National Electric Heating Company, Limited, Queen Street East, Toronto, have just placed on the market two new electric irons, the "Classic" and "Model B," which combine the following essential features:—Leaf unit element, special new plug, proper shape, non-arcing contacts, large



ironing surface, perfect balance. The wide experience of this company in manufacturing heating appliances should be sufficient guarantee of the reliability of these new units. The "Model B" iron is illustrated herewith.

Takes Strain off Binding Screws

The cap of the small separable attachment plug shown herewith is provided with a composition strain-relief split bushing, which when threaded into the top of the cap serves as a handle for withdrawing the plug from the receptacle. The split bushing grips the cord tightly and relieves the binding screws from strain, making unnecessary the tying of a knot. The device is rated at 660 watts at a pressure of 250

volts. The cap is of composition material and is interchangeable with attachment plugs, wall and flush receptacles of either the "T" slot or small, contact type, made by Harvey Hubbell, Inc., Bridgeport, Conn., the manufacturers of the device. The base is either of glazed porcelain or composition material.

A Good Portable Lamp

The illustration herewith shows a portable lamp which is being placed on the market by the Leindorf Electric Light Company, New York. One of the features of this portable lamp is a universal joint, by means of which the lamp can be turned in any direction desired. The lamp is provided with ten feet of cord and all slack cord is wound around a device concealed in the base. The cord is fitted with a push-

plug which is snapped into the socket, no screwing into place being necessary. Use is made of a Cutler-Hammer push-button socket. The shade fits over the bulb as shown and is easily detachable; it is 5 in. in diameter and 2.5 in. high. The diameter of the base is 5.75 in., and with an ordinary 60-watt tungsten lamp, the total height is 12 in. A clamp is attached to the base, which can be fitted to articles with thickness varying from $\frac{1}{8}$ in. to 3$\frac{3}{4}$ in.

Obituary

Mr. Thomas Ross, of the Hawkesbury Electric Light and Power Company, Limited, Hawkesbury, Ont., passed away recently.

A New Principle in Trolley Frogs

There are a great many designs of trolley frogs on the market and each has its good points. Some have advantages over others in the straight under-run and flexible approach features, easy method of installation, and long life under severe operating conditions. Some have the advantage of being designed in only one degree of angle to take care of all conditions regardless of the degree of curvature of the track, necessitating the carrying of only two styles of stock; that is, the right hand and left hand. The latest development in this line is the Westinghouse type BR frog. This is a trolley frog without moveable parts that can be used with perfect

success at points where high speeds are obtained, the design being such that the trolley wheel does not travel on its flanges, and therefore no bump occurs when the bearing of the wheel is transferred from the groove to the flange. It is this bump that invariably dislodges he wheel from the wire.

The illustrations show the Westinghouse type BR frog for a 15 degree angle designed for city service. The malleable iron frog has recently become popular on account of its long life as compared with the bronze frog, although a great many operating men prefer the latter on account of the longer life obtained from the trolley wheels. This argument does not apply to the type BR malleable iron frog, as the resistance to the pasage of the trolley wheel is less than with any design of bronze frog. Therefore a wheel will give longer life operating under the type BR malleable iron frog because the flanges of the wheel never engage the frog body, practically eliminating the arcing at these points. This type can be placed almost directly over the track switch point, preventing the side wear of the wire caused by the wheel riding angularly before entering the frog. When the frog is placed in its proper position the wheel will be in a position

to engage the turn-out runner before it commences to grind the side of the wire. Due to the over-lapping of the runners as shown in the illustrations, there is practically a continuous contact of the tread of the wheel during the period of transition.

Dull Finish Black Paint

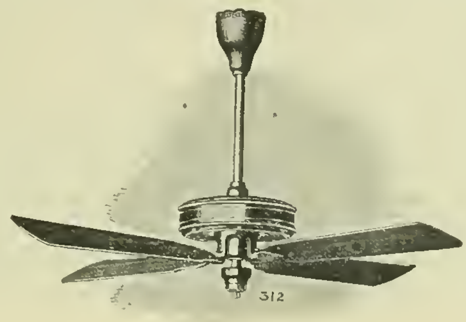
The National Electrical Contractor recommends the following ingredients for a good low-priced black paint for iron and brass electrical fittings. It is said to be reasonably permanent and will dry without a gloss.

Gilsonite, fused	2 lb.
Lamp Black	9 oz.
Boiled Linseed Oil	6 oz.

When applied to metal the paint gives a finish that resembles hard rubber. In compounding the paint:—(1) Melt the gilsonite with a slow even heat. (2) Pour the lamp black into the melted gilsonite and stir. (3) Now add the linseed oil and stir until the composition is even. In using the paint, thin it down to a workable consistency with benzine, as the composition made as above is too heavy for application without dilution.

New Style A. C. Ceiling Fan

This new fan, manufactured by The Robbins & Myers Company, Springfield, O., is of the self-starting, induction type. The field coils are securely attached to the laminated steel core and are thoroughly insulated from it. The rotor is built up of electrical sheet steel laminations with copper conductors securely rivetted to the copper end rings. A ball bearing is used, consisting of upper and lower hardened steel plates ground to size, with the separator containing fourteen large, high grade steel balls. This bearing is immersed in oil. The oil is poured through a hole in the top of the motor body and passes through conductors into the lower oil chamber. A spiral groove in the bearing acts as a centrifugal pump when the fan is operating, thus circulating the oil along the shaft continuously from the lower to the upper chamber. The fan has four blades with a sweep of 54 inches in diameter. The blade length is 23¾ inches; the width is 5½ inches at the shank end, and 6¾ inches at the outer end. The blade shank is supported in the hub directly beneath the motor. The fan is regularly equipped with a 3-point, two-speed switch and regulator. The switch serves to start and stop the fan



A good fan for 1915.

as well as to regulate its running speeds. The fixture box has four holes suitable for standard ⅜-inch brass fixture pipe connection; and the customer can readily wire the motor and attach electrolier fittings for lights of desired. The fan is made for 110 and 220 volts, 60 cycles and at present is made in plain design only.

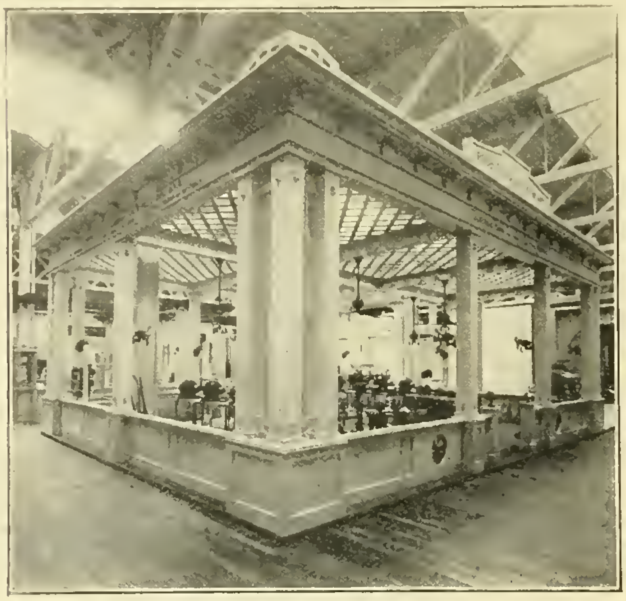
Robbins & Myers Exhibit at the Panama-California Exposition, San Diego, California

The illustrations herewith show exterior and interior views of the exhibit installed by The Robbins & Myers Company, Springfield, Ohio, in the Home Economy Building at San Diego. The central feature of the display is a revolving stand upon which a solid bank of desk fans are mounted in the form of a cone. In addition to the motion of the display as a whole, all of the fans are in operation. A central column

Interior motor and fan display.

with arms branching from the top, supports three ceiling fans which are also in operation. Other fans of all types are mounted at various points about the exhibit.

Immediately surrounding the revolving fan display are circular display benches, upon which the complete line of Robbins & Myers small motors are exhibited, from the 1/40 horse-power size up to 15 horse-power. Direct current motors are displayed on one-half of the circular bench and alternating current motors are shown on the other half. The

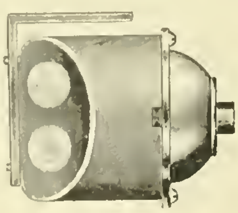


Robbins & Myers San Diego Exhibition.

remainder of the space is given to small machines of all kinds which are equipped with Robbins & Myers motors. The following list of the machines which make up this feature of the display will give some idea of the variety which has been obtained here:—adding machines, addressing machines, portable electrical tools, house pumps, air compressors, vacuum cleaners, ventilating fans, corn poppers, candy furnace, organ blowers, washing machines, cuspidor polisher, carbonator, engraver's machine, knife grinder, bench lathe, humidifier, churn.

High-Voltage Push-Button

A push-button which is similar in size, design and appearance to the ordinary battery push-button and is designated the "push easy" button has been developed by the Russell Electric Company, Danbury, Conn. It is rated at 6 amp. at a pressure of 110 volts and 3 amp. at a pressure of 220

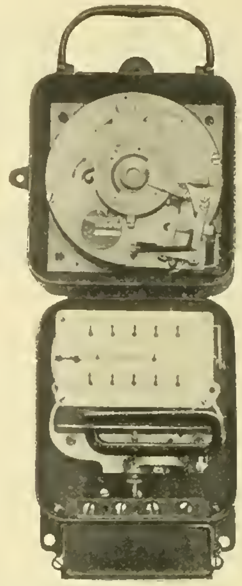


A push-easy button.

volts. The push-button is designed for use with bells, horns, relays and other electrical devices of the open-circuit type. The button closes the circuit only when held in by the finger and opens the circuit when the finger is removed. The button is shown in the accompanying illustration attached to an outlet box made by the above company.

New Two Rate Meter

The Chamberlain and Hookham Meter Company, Limited, of Toronto, have recently introduced a new form of their two rate instrument, in which meter and clock are combined in one case. The difference in this type is that the electrical

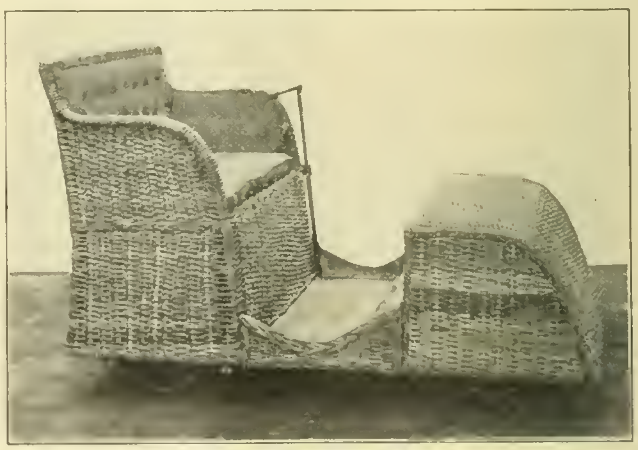


C. & H. two-rate meter.

operation of the two rate counter is replaced by a mechanically operated change-over device. The clock also runs six weeks with one winding and has proven itself much more reliable than electrically-driven clocks since, as the meter is read once a month, it can be wound up at the same time. As will be seen from the illustration the whole forms a neat and compact instrument and has every convenience for handling.

The Electriquette

The illustration shows a two-passenger electric vehicle which will be much in evidence at the San Francisco Panama Pacific International Exposition for which the Electriquette Manufacturing Company, of Los Angeles, have already the order for supplying one hundred. This machine has a normal



Accommodation for two only.

speed of three miles per hour, and sufficient battery capacity to operate it for eight hours on good streets and roads such as will necessarily prevail around the Exhibition Grounds. The body, as will be seen, is of rattan and very comfortable and roomy, as well as being located close to the ground. This type of vehicle is already in operation in the grounds of the San Diego Exposition and is, in fact, the only conveyance permitted on the grounds.

Current News and Notes

Brantford, Ont.

The Lyons Electric Company suffered loss by fire recently.

Crystal City, Man.

The Louisa Telephone Company, Limited, has been incorporated with capital $20,000 and head office in Crystal City

Guelph, Ont.

The Light and Heat Commission of the city of Guelph made a request to the Hydro-electric Power Commission of Ontario to be allowed to collect their accounts quarterly instead of monthly. The reply of the Commission is that "inasmuch as the hydro accounts with the municipalities are all based on monthly payment, they have, for this and many other reasons, found it necessary to adhere to the monthly payment in all except rural municipalities."

Hemmingford, Que.

The Hemmingford Light, Heat & Power Company has been incorporated with a capital stock of $5,000. The object of the company is to supply electric light and power for residences and public buildings of the village of Hemmingford.

Ladner, B.C.

The Taylor Electric, Limited, has been incorporated with capital $10,000 and head office in Ladner, B.C. The object of the company seems to be chiefly to carry on an electrical contracting business.

Medicine Hat, Alta.

The Medicine Hat Light & Supply Company have been awarded a contract for installing the lighting fixtures in the new stores below the Young Conservative Club Rooms.

Montreal, Que.

About 150 men belonging to the Bell Telephone Company have joined the First and Second Overseas Contingents. These employees are from over the entire system of the company. Three of the men died while the First Contingent was in camp at Salisbury Plain.

Mr. Julian C. Smith, the general manager of the Cedars Rapids Manufacturing and Power Company, stated at the annual meeting that the company is now delivering about 50,000 horse power, and that the output will be 70,000 horse power in a short time. This is under the contracts made with the Montreal Light, Heat and Power Company and the Aluminum Company, Massena, N.Y. The transmission lines are owned by the concerns named.

At the annual meeting of Merchants Light, Heat & Power Company, which is controlled by the interests represented in the Cedars Rapids Manufacturing & Power Company, the following were elected: Messrs. J. S. Norris, president; H. Murray, vice-president; D. Lorne McGibbon, R. M. Wilson, Julian C. Smith, directors, and James Wilson, secretary.

The Montreal Board of Control have voted an appropriation of $550,000 for the laying of additional conduits, much of the work being in the nature of linking up the sections already completed. The work will be on a portion of St. Lawrence Boulevard, from Craig Street to Sherbrooke Street, also the section of the city between Notre Dame Street and Commissioners Street, and a further section on McGill Street to St. Lawrence Boulevard; from Craig and St. Antoine Streets from Victoria Square to Windsor Street; on St. James Street from McGill Street to Windsor Street; on Notre Dame Street from McGill Street to Bonaventure Station; and on Windsor Street from Bonaventure Station to St. Catherine Street. The Electrical Commission are preparing plans and specifications for this work.

Very serious damage to the wires of the Bell Telephone Company, Quebec Railway, Light, Heat & Power Company, and the Dorchester Electric Co., was caused by a heavy sleet and wind storm in the ancient capital. The wires came down in every direction, and for several days the city was without power or electric light except for a small section served by the Dorchester Company. Many factories had to close down owing to the consequent loss of power.

At a luncheon of the Montreal Jovian League, Mr. E. N. Hyde, of the Northern Electric, Limited, spoke on the subject of illumination, dealing in particular with the physical characteristics of light and its effect on the eye, and on the question of suitable lighting from the point of effectiveness and its conformity with the architectural and decorative values of buildings.

Newmarket, Ont.

The members of the town council and the authorized officials of the Toronto and York Radial Railway Company, met on March 10th and completed the arrangements for connecting up the town with radial current. It is hoped that service will be begun inside of a month.

Ottawa, Ont.

At the ninth annual meeting of the Ottawa Light, Heat and Power Company, held recently, president T. Ahearn stated in his report that the revenues from all sources totalled $873,654.34, an increase over the previous year of $38,-992.03. The expenses of management, operation and maintenance, together with bond and bank interest, amounted to $663,091.39, being $96,196.01 in excess of last year, due to increase in the city taxes and interest on current liabilities. The net surplus for the year was $240,562.95. The balance at credit of profit and loss account, with the addition of this year's surplus is $274,926.26. From this four quarterly dividends at the rate of 8 per cent. per annum were paid, amounting in all to $259,727.05. After making provision for bad and doubtful debts there remains $9,697.91 at credit of profit and loss account. The sum of $539,438.60 has been expended on capital account during the year, which included the cost of completion of a new steam turbine unit, the extension of pole lines, etc. The exceptionally low water in the Ottawa River last year cost the company an extra $50,000 in their coal bill. The following were elected to the board of directors for the ensuing year: President, T. Ahearn; vice-president, Hon. E. H. Bronson; Travers Lewis, K.C.; James Manuel, Warren Y. Soper, C. J. McCuaig, D. R. Street, F. W. Fee.

Peterborough, Ont.

The Board of Arbitrators, consisting of His Honor Judge Huycke, chairman; Hon. Wallace Nesbitt, Toronto, and Mr. R. A. Ross, C.E., consulting engineer, Montreal, have handed down their judgment in the matter of the price to be paid by the city of Peterborough for the property of the Peterborough Light and Power Company, Limited, recently expropriated. At the time of expropriation, the city paid the company $100,000. An additional $54,615 is, by the recent judgment, awarded to the company. The city are also required to pay the costs of the arbitration and interest on the amount due the company at the rate of 5 per cent., since the 1st of October, 1914.

Electrical News
Generation Transmission and Application of Electricity

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The Power of Aggressive Methods

The possibilities for business extensions and great reductions in many of our smaller towns when full advantage is taken of modern methods of development, distribution and management, are splendidly illustrated in the case of the town of Selkirk, Man. Five years ago the resident consumers in this town were paying 20 cents per kw.h. for a night service only. Today they are paying 7 cents for a 24-hour service. In addition, this town gives a special cooking rate of 2 cents per kw.h. Under the original system the total connected load never exceeded 125 h.p.; at the present time the connected load is over 700 h.p. This town claims to have the lowest lighting rate west of Winnipeg with the exception of Calgary, and the lowest heating and cooking rate west of Winnipeg without exception. A brief description of this plant and the way these results have been accomplished are noted at length elsewhere in this issue.

It may be argued that Selkirk was unusually advantageously situated in being able to purchase power from a large utilities company, operating in the neighborhood, but we suspect that much of the success is due to good management and the progressiveness of the officers in charge, in taking advantage of present-day methods of extending their system. Lack of expansion in the business of many of our central stations during the past few years has been due to failure to appreciate that the people will respond to better service, courteous treatment, and lower rates, to such an extent as to make these changes of policy a good investment. The electrical authorities of Selkirk have evidently guessed this, and given their customers what they want. Their customers in response have come forward with increased demands for electric power in its various forms. Selkirk's situation could be duplicated in scores of Canadian towns, if the Selkirk methods were adopted. In connection with the article we print a number of interesting figures, not so much on account of the value of the figures themselves as to show the systematic manner in which the business of the corporation is tabulated for immediate reference. The municipality or company that has no means of knowing whether conditions of to-day are an improvement on conditions of yesterday, lacks one of the chief incentives to improve the conditions of to-morrow.

Quantity of Light, or Quality?

Good lighting in the home is coming to be more than a mere catch phrase. Too long it has meant nothing better than plenty of light—in many cases excess of light. Even from men who ought to know better—and do—we often hear some such remark as that they now have a nitrogen lamp in their den, and so on—"current costs nothing, you know."

After all, is it not possible that the cheapness of electric light has reacted on itself and defeated the very object we have had in view in striving for it—in fact, can it not be said that, as used at present, it adds to our discomfort and tends to reduce our physical fitness? We think this is so in many cases.

We believe the significance of cheap light has been very generally misunderstood. Perhaps this is natural and that the reaction against the conditions of semi-darkness in which we have, through the past ages, been forced to spend our evenings, has led us to crave the other extreme. Doubtless the pendulum will soon swing back and we shall realize that excessive light loses its attractiveness when it ceases to be a novelty. The real value of cheap light will then be better understood.

But we shall never come to a proper realization of the value of cheap electric current until we fully appreciate the difference between bright lighting and correct lighting. Under certain possible conditions, these two terms may coincide to some extent, but, on the other hand, there are innumerable cases where a much subdued light, properly controlled, is both more beautiful and more restful. It seems to be a mistake to endeavor to duplicate daylight in our homes at night. Daylight is synonymous with activity of body and brain and absorption in business affairs. The illumination of the home should induce relaxation of mind and body and appeal to and tend to develop those qualities of men and women not shown in daily life, chief of which is the gift of appreciation of beauty in art, music, literature and, last and greatest, character.

Here then is the task to which our illumination engineers must set themselves, and the essential, so long lacking, is now abundantly available—cheap light. The other essential is proper "control" of the light; in this also our manufacturers have done wonders in the last few years. The tools are therefore to hand; it only remains to apply them. The illumination engineer of to-day must be a man with an appreciation of what constitutes correct lighting, and he must also be an expert in the use of his tools. Truly the harvest is abundant, but the laborers are few.

Electricity in Mines

The Board of Commissioners recently appointed by the Government of the Province of Nova Scotia to enquire into the use of electricity in the mines of the province, have published their report. This is especially interesting, inasmuch as we believe it is the first Canadian report of its kind ever prepared.

Information was gathered by the commissioners through

personal investigations of all the mines in Nova Scotia at present using electric power, and by taking the evidence of some 88 witnesses, including managers, superintendents, engineers and other persons more or less intimately connected with the use of electricity in the various mines. As a result of their investigations, the commissioners state their belief that in the remote future, electricity will be the power generally used in mines. They state for example, that evidence was constantly offered that thin seams can only be profitably worked where electricity is used, and quote an example of evidence received, where a seam which averaged only 18 inches was being worked at a profit by the use of electrically operated equipment. Their report also states that the lighter seams of various companies, which could not be worked by steam or compressed air, will, by the use of electricity, become workable propositions.

The report outlines in considerable detail the dangers attending the use of electricity, and discusses at length the construction of electrical plants and apparatus suited for mine work, grounding of metallic coverings, electric miners' lamps, etc. As a result of the investigations of the Commission, a series of regulations covering the installation and use of electricity in the coal mines of Nova Scotia is appended to the report.

New T. E. L. Co. Rates

The Toronto Electric Light Company recently announced a very substantial reduction in their rates for both lighting and power. Up to the present time this company has given free renewals of carbon lamps, and this privilege has now been extended to tungstens of 60-watt sizes and over. The new rates follow:—

Residence Rate.—The first 4 kw.hrs. per room, at 5c. per kw.hr.; the next 4 kw.hrs. per room, at 3c. per kw.hr.; the remaining monthly consumption at 1½c. per kw.hr.; 10 per cent. discount ten day payment. For houses under four rooms, minimum charge 25c. per month, otherwise no minimum charge. This rate includes the free installation and renewal of 8 c.p. and 16 c.p. carbon lamps, and of tungtsen lamps 60 watts and over. In arriving at the number of rooms to be charged, no unfinished attic rooms, unfinished cellar, bathrooms nor halls are counted, unless the halls are used as living rooms; in other words, the common real estate rating of houses is taken.

Commercial Lighting Rate.—The first 30 hours use of the maximum demand, at 6½c. per kw.hr.; the next 70 hours use of the maximum demand, at 3½c. per kw.hr.; the remaining monthly consumption at 1c. per kw.hr.; 10 per cent. discount ten day payment. Minimum charge 75c. per kilowatt of demand per month. This rate includes the free installation and renewal of tungsten lamps of 60 watts and over to customers using TELCO service exclusively. In arriving at the maximum demand the first kilowatt of connected load is taken at unity, and the remainder at 75 per cent.

3-phase, 550-volt, and single-phase 230-volt power.—$1.25 per h.p. of maximum demand for the first fifteen h.p. per month; $1.00 per h.p. for the remaining monthly demand; plus a current charge of 1½c. per kw.hr. for the first 50 hours use of demand, .8c. per kw.hr. for the second 50 hours use of demand, and .2c. per kw.hr. for the remaining monthly consumption. 10 per cent. discount ten day payment.

230-volt Direct Current Storage Battery Power.—$1.25 per h.p. of maximum demand for the first fifteen (15) h.p. per month; $1.00 per h.p. for the remaining monthly demand; plus a current charge of 2½c. per kw.hr. for the first 50 hours use of demand; 1c. per kw.hr. for the second 50 hours use of demand; .5c. per kw.hr. for the remaining monthly consumption. 10 per cent. discount ten day payment.

500-volt Direct Current Power.—Same rate as 230-volt storage battery power, with 15 per cent. prompt payment discount.

Canadian Telephones

The Department of Railways and Canals have just issued their report for the year ended June 30th, 1914, covering telephone statistics of the Dominion of Canada. The number of systems is reported during the year covered as 1,136, as compared with 1,075 in the previous year. The report states, however, that it should not be assumed that this number represents all the corporation or private units throughout the Dominion, as the full number of units would probably exceed 1,200. For various reasons, the report states, the efforts to secure data from all of these were not successful.

The total number of organizations as divided among the various provinces of the Dominion are as follows: Nova Scotia, 83; New Brunswick, 24; Prince Edward Island, 1, Quebec, 127; Ontario, 468; Manitoba, 38; Saskatchewan, 369; Alberta, 9; British Columbia, 16; Yukon, 1; the organization being divided into the following classes: government, 4; municipal, 58; stock, 611; co-operative, 297; partnership, 48; private, 118.

The total stock and funded debt liabilities of these companies is now $70,291,884, as compared with $59,847,004 the previous year. The capital liability per telephone is now $134.88, as against $129.13 the previous year. Gross earnings in the past year were $17,297,269 and the net $4,414,867; these figures are respectively $2,399,991 and $657,228 larger than in 1913. Gross earnings in the last year were $33.16 per telephone in use, as compared with $32.13 in 1913. Operating expenses averaged $24.72 per telephone, as compared with $24.10 one year ago.

The number of miles of telephone wire in use now amounts to 1,343,090, divided as follows: urban, 962,947; rural, 380,143. There is one mile of telephone wire in use for every 6.0 of our population, as compared with 6.8 the previous year. The number of telephones in use is now 521,144, representing a gain of 57,473 over 1913. This means one telephone in use for every 15.5 of population. It is claimed that only one other country, the United States, has a larger number of telephones in use on the basis of population.

The 1,343,090 miles of wire are made up as follows: galvanized iron, 365,776; copper, 62,960; overhead cable, 348,536; underground cable, 563,683; submarine cable, 2.135.

Sarnia Plant Extended

The Sarnia Gas & Electric Light Company have just completed the installation of a new 1,250 kv.a. turbo-generator, which will more than double the generating capacity of their present plant. The turbine is a Westinghouse-Parsons high pressure type, running 3,600 r.p.m. with Le Blanc jet condenser and air-pump guaranteed to maintain a 28-in. vacuum. The condenser pump is turbine driven, the exhaust of this turbine being piped to the larger turbine, which would allow the steam to be used again, or to an open heater which supplies the boiler feed water, thus making this a very economical unit. The generator unit is 1,200 kv.a. capacity, 2,400 volt, 3-phase, 60-cycle. Excitation is supplied by an existing 15 kw. motor-generator exciter set, which has just been installed. It will be remembered that about two years ago the power plant of the Sarnia Gas & Electric Light Company was completely destroyed by fire, since which time an entirely new fire-proof building and equipment of the very latest type have been installed. The company have been greatly reducing their rates, and it is understood that with the inauguration of the new unit, a further reduction will be announced. With well over 2,000 kw. capacity of highest class ma-

chinery, it is evident that the company can take care of Sarnia's needs with entire satisfaction for some time to come. Mr. J. O. B. Latour, of the Canadian Casualty Company, Toronto, has been consulting engineer on the installation throughout. Complete illustrated description of this company's power house and equipment appeared in the Eectrical News of February 15th, 1914.

Telegraph Statistics, 1914

The Department of Railways and Canals have just issued their "Telegraph Statistics" of the Dominion of Canada for the year ended June 30th, 1914. The total number of pole miles operated in Canada by the eight companies is 45,061, made up as follows: Canadian Northern Telegraph Company, 5,780; Canadian Pacific Railway, 13,576; Dominion Government, 9,933; Grand Trunk Pacific, 3,144; Great North Western, 9,409; North American Telegraph Company, 44; T. & N. O. Railway Commission, 343; Western Union, 2,832. By provinces the pole mileage is as follows: Nova Scotia, 2,932; New Brunswick, 1,910; Prince Edward Island, 14; Quebec, 6,851; Ontario, 11,258; Manitoba, 3,909; Saskatchewan, 6,749; Alberta, 4,050; British Columbia, 6,700; Yukon, 688. The number of land messages carried by both the Canadian Pacific Railway Company and the Great North Western Telegraph Company during the year exceeded 4,000,000, being 4,373,675 in the first case, and 4,422,326 in the second. Only two other companies exceeded a million, viz., the Canadian Northern, 1,111,087, and the Western Union, 1,086,288.

The Rideau Power Co.

A power company has been incorporated at Merrickville, Ont., under the name of the Rideau Power Company. The plant is laid out for two units of 562 kv.a. each, one of which is now being installed. The water wheel will develop 650 h.p. under a head of 26 ft., and the generator is designed for normal operation at a load of 562 kv.a., 600-volt, 3-phase, 60-cycle, 240 r.p.m. This generator is supplied with direct connected exciter. The equipment also includes four panel marble switchboard.

The electrical apparatus was made by the Swedish General Electric, Limited, and the hydraulic equipment by the Wm. Hamilton Company, of Peterboro. The water wheel governor was made by the Lombard Governor Company.

Only one unit at present is being installed. The wheel is now being erected and the generator has been delivered at the plant and will be erected shortly. Power will be chiefly supplied to surrounding factories, a number of which are within a few hundred yards of the power plant. It is expected this plant will be in operation in about one month's time.

Renewable Fuses

An article in the March 15th issue of the Electrical News was made to say that the Daum type of refillable fuse is "in accordance with the rulings of the National Board of Fire Underwriters." We wish it to be distinctly understood that this is not to be interpreted to mean that the Daum fuse is approved by the Underwriters' Laboratories, though this was our understanding of the matter when the item was printed.

We make this statement lest any of our readers should place the same general interpretation on the words "in accordance with the rulings," as we ourselves did. In this we were further influenced by the knowledge that the Underwriters' Laboratories had, about December 1st last, issued a preliminary report to a certain manufacturer of refillable fuses, officially signed, indicating favorable action on some of his products. We did not know then what we have since learned, that official approval of the council of the Underwriters' Laboratories was never secured, and that the original approval cards were withdrawn.

The following extract from an official letter just received from the Underwriters' Laboratories, in response to our letter of enquiry, places the matter in its correct light:—

"We would advise that the Laboratories never have issued approval on any renewable cartridge fuse, as the specifications of the National Electrical Code, at least up to the present time, have been interpreted to prevent the recognition of fuses of this type. As you know, the public generally interpret the words "National Code Standard," "Compliance with requirements of the Code," and similar statements to mean that the devices to which they are applied have been approved by us and included in our List of Electrical Fittings. While we cannot take action against the user of such phrases, who may by a literal interpretation of the words justify himself, we still feel that such methods of advertising might be criticized as not being wholly ingenuous."

Stimulating the Use of Electrics

The importance of the sale of electric current for electric vehicles is evinced in the many ways in which central stations both here and abroad are stimulating it through active co-operation with the vehicle manufacturers. The chief means is by uniting scattered forces into electric vehicle associations for concentrated and intensive promotion of all conceivable uses of electrics. Such an association is active now in England, and an interesting feature of its work lies in the fact that during the present war crisis, all available "petrol" and horse-drawn vehicles have been commandeered, leaving the electric alone in the field, where it is surely making good,—for without real merit, efforts to boost its popularity would naturally be futile.

The West Ham Electric Power Supply Company, England, seized this opportunity for "Business Unusual" to publish the solution of the transportation problem. This company comes to the aid of dispossessed and perplexed vehicle users by teaching, through the medium of some remarkably striking posters, the convenience and reliability of electric vehicles and the low cost of current to run them. This movement is lauded by the London Electrical Times, which urges that every power company in England follow West Ham's example. To supply this unique demand, American electric automobile manufacturers have established a brisk trade in England through the intermediary of the Electric Vehicle Association of America, which co-operates with interests in England and Canada, and also in Australia and South America.

This American association has localized sections in leading cities throughout the United States, and central station co-operation forms a great part of its work. Through its offices many central stations throughout the United States are working together to expand the electric vehicle industry. They are accomplishing this partly by building up a network of charging stations all across the country. At the same time these sections are doing intensive work in their own localities, and establishing emergency boosting stations; by running automobile bureaus and electric car sales agencies; by standardizing and lowering rates for current; by supplying gratis the services of specialists in electric vehicle operation; by devoting a good part of their publicity to the electric automobile aspect; and by circulating maps of routes and tours indicating charging stations along the way, and also in publishing special lists, data, and articles.

A result of this work is seen in the co-operative garage recently opened by the New York Electric Vehicle Associa-

tion, under the auspices of the New York Edison Company, at Central Park West, and 62nd Street. As this is a crystallization of all phases of electric vehicle promotion work which central stations are doing, it can be used as a cross-section in examining the whole development. Its principal elements are these: the New York association has opened the garages in co-operation with a number of leading manufacturers of electric pleasure cars. Three different companies have show rooms in the building, making it their headquarters. The garage will start with accommodations for 150 cars, over a 100 of which have already been secured. There will be a fixed charge for privately-owned cars of $45 a month, which will include battery charging, care of the car, and taking it to and from the owner's residence and the garage. The object is to provide a large, centrally located home of their own, and receive special care and attention, thus facilitating the adoption in New York City of a car that is exceptionally well fitted for town use.

A Chicago garage has adopted a novel method of stimulating electric use which has been practised with much success. It is an outcome of vehicle laws which prevent unattended vehicles standing at curbs longer than set periods. It consists of furnishing owners of electrics with a special call and delivery service from hotels and department stores. Uniformed men known as "hikers" are stationed at a prominent store in the business district where they await summons of electric car owners who wish their cars cared for while they are shopping or otherwise engaged downtown. By notifying the hiker the car is driven back to the garage or returned to the owner at an appointed time and place without charge.

These instances illustrate specifically some of the detail work in the general promotion scheme. It must be borne in mind, however, that success in popularizing the electric is due, as it is in the promotion of anything else, not upon a comprehensive promotion system, but fundamentally upon the intrinsic worth of the thing itself, and because the electric automobile has this, its growth is surely and steadily becoming greater. The systematized co-operation in pushing this, is, however, certainly worthy of note and emulation. The underlying significance of the whole movement is not, indeed, the mere fact that central stations are advancing the electric vehicle industry for their own advantage, but rather, it is an example of that remarkable team work which is the key-note of to-day's commercial system, and which makes its magnitude possible.

Electric Expansion in the Town of Selkirk

Sixty-three Per Cent. of Houses Wired and Connected—Increased Business More than Compensates for Lowered Rates—Gross Revenue Doubled in Two Years

The Town of Selkirk is very fortunate in being located within easy reach of the utilities distributing power generated on the Winnipeg River.

About the year 1893, some years before any hydro-electric power had been brought into Winnipeg, a franchise was sought by a private corporation for the purpose of distributing light and power in Selkirk. A contract was finally entered into, and a plant and distribution system installed serving the greater part of the town. The rate charged was 20c. per kw. hour, with a discount of 10 per cent. for prompt payment for business and residential lighting, and $2.50 per month for each 16 c.p. carbon lamp for street lighting. For some time before this plant was closed down there were 52 of these street lamps in use.

In the early life of this plant, when the electrical industry was not so well developed as at present, the plant took care of all business offered and was fairly satisfactory. However, as other cities and towns installed more up-to-date plants and rates were reduced below those in operation in Selkirk the citizens began to complain and to ask for improvements in the lighting situation. The plant as erected consisted of a 60 kw. generator, with necessary engine, boilers, switchboard, etc., which were necessarily of rather primitive design, having been put in at an early date. The generator was a smooth body machine, bound with pancake coils, and the switchboard of the old wooden variety with knife switches. The line becoming old frequent breaks occurred, and many street lights were out sometimes for two or three nights in succession.

In 1908 negotiations were entered into between the town and the company for the transfer of the property to the town. W. E. Skinner, consulting engineer of Winnipeg, was employed to place a valuation on the plant and to negotiate with the company for such transfer. As the valuation was higher than the town was prepared to pay and lower than that placed on it by the owners, the matter was dropped. Conditions became worse until the plant was closed down, and during the winter of 1910 and 1911 the town was without electric light, the owners of the plant claiming that it could not be made to pay.

Several meetings were held by the citizens to discuss ways and means for providing light for the town in future. The town council decided that the town must be lighted from some source, and different firms were invited to tender on the supply of a plant or a proposition for securing a franchise. The most attractive of these was for a gas producer plant to be municipally owned and operated. Mr. Skinner was again called into consultation, and acting on his advice negotiations were entered into with the Winnipeg, Selkirk and Lake Winnipeg Railway Company, a subsidiary of the Winnipeg Electric Railway Company, for the supply of energy. A contract was finally arranged with them for a minimum amount of 100 h.p., 2,200 volt, 60-cycle, 3-phase at a price of $30.00 per h.p. per annum, to be purchased on a peak load basis of 20 minutes duration, the town to construct, own and operate the distribution system. The necessary legislation was secured for this purpose.

During the summer of 1911 the distribution system was constructed, and the town commenced to receive power from the Winnipeg, Selkirk and Lake Winnipeg Company in November of that year. An inspection of the wiring in the 71 premises which had been customers of the old plant revealed the fact that only 12 of these were up to the standard of the Underwriters' rules, and the new plant commenced operation with that number. The street lighting apparatus was late in arriving so that at the beginning of 1912 there were not more than 25 consumers connected on the line. At the end of 1914 there were 390 consumers and 180 80 c.p. series street lamps installed.

To show what has been accomplished in this plant tables are herewith submitted giving data of the operation from January 1st, 1913, to December 31st, 1914, with comparisons showing the increase or decrease from year to year, the assets and liabilities of the electric light department, and a statement of revenue and expenditure.

After the construction of the plant under Mr. Skinner's direction, Mr. Robert Maurice, who had acted as superin-

REVENUES RECEIVED

Month	1913 Domestic Lighting	1913 Street Lighting	1913 Power	1913 Sundry	1913 Total	1914 Domestic Lighting	1914 Street Lighting	1914 Power	1914 Heating and Cooking	1914 Municipal Pumping	1914 Sundry	1914 Provincial Asylum	1914 Total
January	$1375.35	$378.12	$39.16	$10.50	$1812.13	$1148.72	$495.42	$164.53	......	$ 57.12	$ 3.00	$324.52	$2193.31
February	1663.24	251.40	74.00	2.00	1990.64	1015.36	337.80	156.20	......	60.48	3.00	......	1572.84
March	983.12	330.66	129.25	3.60	1446.63	616.18	286.38	113.00	......	56.78	5.00	......	1077.34
April	742.43	262.80	49.39	15.25	1069.87	673.20	401.52	182.81	......	79.50	7.00	683.75	2027.78
May	665.39	237.24	55.60	68.58	1026.81	607.32	262.82	192.50	......	65.42	10.50	163.14	1301 70
June	702.66	185.78	57.85	6.80	953.06	636.62	233.94	130.97	......	105.84	8.00	......	1115.37
July	455.26	205.32	63.64	3.50	727.72	698.74	238.76	168.45	......	124.60	3.00	58.14	1291.69
August	816.69	207.54	96.17	16.00	1136.40	733.22	309.96	206.50	$11.96	61.60	58.14	116.48	1497.86
September	906.99	308.76	79.20	26.30	1321.25	1060.92	369.52	80.01	41.60	75.00	10.86	94.08	1731.99
October	666.01	411.66	76.61	14.76	1169.04	627.66	461.70	206.40	31.17	75.00	8.50	......	1410.43
November	1396.94	335.88	185.05	32.25	1950.12	1562.26	458.52	674.59	21.74	72.89	5.40	......	2795.40
December	1208.30	313.76	196.18	43.41	1761.65	584.57	229.26	337.29	10.87	36.44	2.70	511.09	1712.22
Total	11582.38	3437.89	1102.10	242.95	16365.32	9964.77	4085.60	2613.25	117.34	870.67	125.10	1951.20	19727.93

COST OF OPERATION

Month	1913 Operating and Wages	1913 Maint. and Repairs	1913 Purchase Price of Energy	1913 Int. and Debenture	1913 Total	1914 Operating and Wages	1914 Maint. and Repairs	1914 Purchase Price of Energy	1914 Int. and Debenture	1914 Total
January	$125.00	$ 90.00	$250.00	$262.00	$727.00	$310.20	$72.25	$335.00	$254.00	$971.45
February	250.00	107.30	250.00	262.00	869.30	286.20	70.00	352.00	254.00	962.20
March	215.00	98.65	250.00	262.00	825.65	384.25	74.50	337.00	254.00	1049.75
April	185.00	92.00	250.00	262.00	789.00	293.00	65.60	315.00	254.00	927.60
May	247.50	105.50	250.00	262.00	865.00	239.00	78.90	301.25	254.00	873.15
June	215.90	98.00	250.00	262.00	825.90	358.92	69.00	318.25	254.00	1000.17
July	246.80	99.30	250.00	262.00	858.10	211.14	75.50	335.00	254.00	875.64
August	232.20	93.75	250.00	262.00	837.95	228.55	72.00	351.75	254.00	906.30
September	253.25	103.55	250.00	262.00	868.80	243.98	72.50	361.80	254.00	932.28
October	233.53	92.50	335.00	262.00	923.03	279.40	71.15	408.70	254.00	1013.25
November	223.00	104.80	412.50	262.00	1002.30	267.02	73.35	402.00	254.00	996.37
December	320.60	98.65	392.50	262.00	1073.75	247.97	94.52	402.00	254.00	998.49
Total	2747.78	1184.00	3390.00	3144.00	10465.78	3349.63	889.27	4219.75	3048.00	11506.65

KILOWATTS SOLD

Month	1913 Domestic Lighting	1913 Street Lighting	1913 Power	1913 Total	1914 Domestic Lighting	1914 Street Lighting	1914 Power	1914 Heating and Cooking	1914 Municipal Building	1914 Municipal Pumping	1914 Prov. Asylum	1914 Total
January	12978	6452	956	20386	12465	8257	3448		329	1190	4190	29879
February	9108	7490	1295	17893	11302	4878	4450		79	1260	3090	25059
March	8033	3201	1450	12684	8871	4773	2288		119	1110	2590	19751
April	7099	4380	1066	12545	11070	8692	4017		60	1580	2590	28009
May	5443	3954	1171	10568	7463	4041	4189		281	1290	1020	18284
June	6874	3095	1145	11114	8785	3899	4507		82	1960	1040	20273
July	4751	3422	1600	9773	8583	3944	4337	117	136	2580	860	20557
August	3908	3459	2624	9991	8076	5166	4314	2027	207	1210	1350	22349
September	8198	5146	1852	15196	7965	6492	3694	2352	485	1475	2060	24523
October	10237	5255	1851	17343	11426	7696	6119	2249	442	1475	3170	32577
November	11957	5598	4500	22055	10312	8642	10560	1433	447	1390	2670	35454
December	11594	4248	4180	20022	5156	4321	5280	716	223	695	1335	17726
Totals	100180	55700	23690	179570	111474	70801	57202	8894	2890	17215	25965	294441

tendent of construction, took charge of the operation, and has continued in this position to the present time. Dr. D. G. Ross has been mayor of the town throughout the entire period of the installation and operation of this plant, and to him, the electric light committees working with him, and to Mr. Maurice, the manager of the plant, great credit it due for the success attained in the operation of this system.

It is interesting to note that reductions in the rates as recommended by the manager, have been carried out with the sanction of the Public Utilities Commissioner of Manitoba, and the proposition of securing new customers from the tenants is now well under way.

The following extracts taken from the report of the manager of the plant to the town council under date of February 19th, 1915, is of interest:

"In the years 1912 and 1913 we had only two rates to offer the people, viz.: lighting at 10c. and power at 6c. per kw. hour, while our revenue for the said two years was $11,000 and $16,000 respectively. In 1914 our gross revenue was about $20,000, although we had lowered our lighting rate more than 25 per cent. and had introduced three additional and cheaper rates to the people. In 1914 our gross income amounted to $75.71 per consumer, or $9.21 per capita, and on each $100 invested we had a gross income of $59.65, or a net earning of $17.89.

"You are aware that our method of business is to pur-

COMPARATIVE CONSUMPTION 1913 AND 1914.

Increase of 1914 over 1913. Minus sign — Indicates Decrease. / Per Cent. of Energy Consumed in Each Branch, 1914.

Month	Domestic Lighting K.W. Hrs.	%	Street Lighting K.W. Hrs.	%	Power K.W. Hrs.	%	Total K.W. Hrs.	%	Domestic Light'g	Street Light'g	Power	Heating and Cooking	Municipal Bldg.	Municipal Pump'g	Prov. Asylum
January	513	4	1805	28	2492	261	9493	47	42	28	12	..	1.1	4.0	14
February	2194	21	2612	-35	3155	243	7166	40	44	19	18	..	.3	5.0	12
March	838	10	1572	49	838	58	7067	56	45	24	12	..	0.6	5.6	13
April	3971	56	4312	98	2951	277	15464	123	39	31	14	..	0.2	5.6	9
May	2020	37	87	2	3018	257	7716	72	41	22	23	..	1.5	7.1	5.6
June	1911	28	804	26	3362	293	9159	82	43	19	22	..	0.4	9.7	5.1
July	3832	81	522	15	2737	171	10784	110	42	19	21	0.6	0.7	12.6	4.2
August	4168	106	1707	49	1689	64	12358	124	36	23	19	9	0.9	5.4	6.0
September	—233	3	1346	26	1842	99	9327	61	32	26	16	10	2	6.0	8.4
October	1189	12	2441	46	4268	230	15234	88	35	24	19	7	1.4	4.5	9.7
November	—1645	—14	3044	54	6060	135	13399	61	29	24	30	4	1.3	3.9	7.5
December	—6438	—56	73	1.7	1100	26	—2296	—11	29	24	30	4	1.3	3.9	7.5

chase electrical energy and in turn sell it at a profit. With this in mind I beg to call your attention to the fact that in 1912 we sold our energy for 3½ times what we paid for it, in 1913 four times, and in 1914 five times the amount paid.

"In the year 1914, 38 per cent. of our entire sale of energy went to domestic lighting, 19 per cent. to commercial power, 3 per cent. to domestic heating, and 5 per cent. to municipal pumping. It is gratifying to note that we had an increase of 11 per cent. on domestic lighting, and 141 per cent. on commercial power over the previous year.

"In 1912 it cost us 6.5c. per kw. hour to purchase and handle energy, in 1913 5.8, and in 1914 3.9c. Therefore, we have reduced our handling and purchasing cost nearly 40 per cent. in 3 years.

"In 1914 our Domestic Lighting rate was 8c. per kw. hour with discounts up to 25 per cent., yet we received in actual cash an average of 8.8c. per kw. hour. This was caused by a collection of the minimum charge where consumers did not use the energy paid for.

"In the year 1914 for purchase of energy and operation we had an expense of $2.73 per consumer per month, while our gross revenue per consumer was $6.30 per month. Our total labor and salary cost is equal to $1.08 per consumer

KILOWATT HOURS LOST IN DISTRIBUTION—1914

Month	Transmission Loss	Meter Loss	Transformer Core & Copper Loss	Total Distribution Loss	30 Min. Peak Load	Load Factor	Total Station Output
January	642	95	2115	2852	134	41	32751
February	506	95	1930	2531	140	33	27590
March	574	95	2203	2872	135	37	22623
April	592	95	2276	2963	126	41	30972
May	624	95	2401	3120	120	28	21404
June	663	95	2277	3035	127	30	23168
July	530	95	2026	2651	134	28	23208
August	586	95	2252	2933	140	30	25282
September	597	95	2295	2987	144	32	27510
October	632	95	2433	3160	163	37	35737
November	582	95	2233	2910	163	41	38364
December	500	47	1717	2264	163	20	19990
Totals	6908	1092	26158	34158	141	39	328599

per month. In 1914 we rendered 4,000 accounts, at a total cost of 22c. per account, paying for printing, stationery, postage, bookkeeping, etc. During the months of June and July last year our sales department disposed of $1,700 worth of electrical apparatus, all of which will be a source of revenue indefinitely. We secured 31 contracts—a total of 59 kilowatts—on the 2-cent heating rate, and 109 kilowatts on the 8c. lighting rate. The total cost of installing the heating circuits was $813, and our revenue therefrom is equal to 34 per cent. on the investment.

"It might interest you to know that we have 17 motors installed giving a total of over 440 h.p., which includes the supply of motive power to such as tailoring and printing establishments, machine shops, bakery, shipyards, bottling works, hospitals, hotels, asylum, planing mills, poultry farm, —in fact we serve as varied industries as many larger cities.

"We have 56 transformers installed, with a capacity of 950 h.p., 24 of which are assigned to power service, 21 to lighting, and 11 to heating. Our distributing system reaches 26 different streets, and consists of over 100 miles of wire, 5 miles of pole line, and over 390 meters, having 63 per cent. of all the houses in the town wired and connected.

COST PER KILOWATT HOUR

Month	Cost per Kilowatt Hour 1913	Cost per Kilowatt Hour 1914	Comparison of Revenues 1913	Comparison of Revenues 1914
January	3.6	3.2	$1812.13	$2193.31
February	4.9	3.8	1999.64	1572.84
March	6.5	5.3	1446.63	1077.34
April	6.3	3.3	1069.87	2027.78
May	8.2	4.8	1026.81	1301.70
June	7.4	4.9	953.06	1115.37
July	8.8	4.3	727.72	1291.69
August	8.4	4.1	1136.40	1497.86
September	5.7	3.8	1321.25	1731.99
October	5.3	3.1	1169.04	1410.43
November	4.5	2.8	1950.12	2795.40
December	5.4	5.6	1761.65	1712.22
Total	5.8	3.9	16365.63	19727.93

"During the year 1914 we indirectly secured 44 houses, as new consumers, by means of the easy payment plan for wiring them. I take pleasure in saying that every payment has been made with interest. I am convinced that a similar scheme could be applied to the tenants, whereby we could rent the installation, and bring about a mutual benefit to all concerned. You will note that we still have 185 houses not wired, which are occupied mostly by tenants.

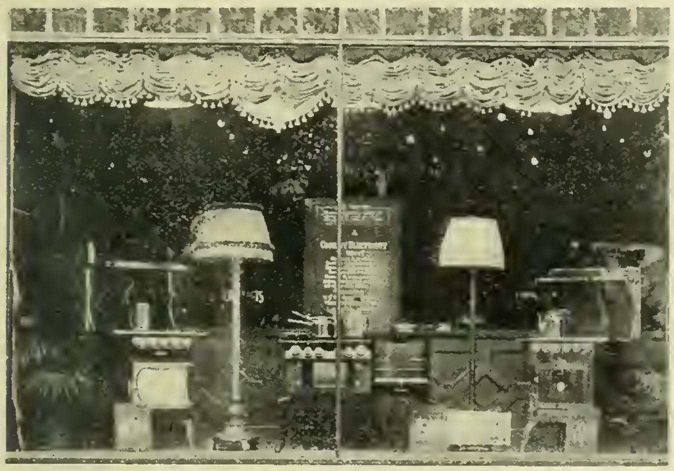
"A look into our financial statement for last year will convince you that we can easily reduce the lighting rates for this year. I would therefore recommend a reduction of 1c. per kw. hour on domestic lighting, and reducing the minimum charge from $1.00 to 75c. per month; also the reduction from 6c. to 5c. net on the rate for moving picture machines, signs, windows, and exterior lighting."

Utility Advertising That Brings Results

Attractive Window Displays and Demonstrations Pay Biggest Dividends—Train the Public to Look for Something New Every Week

The value of publicity is only proven by its attendant results. In such a matter as this, the experience of others who have tried it out thoroughly (and often at considerable expense), ought to be as valuable as one's own personal experience, and just that much cheaper.

Where competition is keenest (and this is what develops the greatest efficiency), attractive window and interior displays and demonstrations are a very prominent feature. This is supplemented generally by carefully compiled statistical information, showing to what extent the demand for any particular article has been stimulated by the extra publicity. Almost without exception, these figures show that the public are taking notice and being influenced accordingly. Where the advertising has been conducted by experienced men and women, and with due reference to the seasonableness of the exhibits, it has been shown in almost enough cases to constitute it a rule, that results are in direct proportion to the frequency with which the advertising is varied. The public

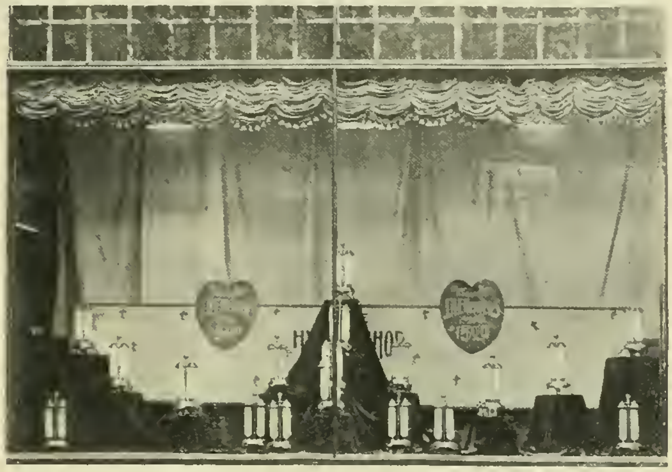


Display of Ranges.

is always looking for something new, and when they come to understand you are laying yourself out to satisfy this craving, they will watch you carefully. The sale is half made when you interest your customer.

As an example of what the Toronto Hydro-electric Commission are doing, we reproduce cuts of a recent window display. This hydro store is probably the most systematically conducted, as an advertising proposition, in Canada. We are speaking now with reference only to electric stores. The same window display is never allowed to stand more than one week, and the new display is always so entirely different from the old, that passers-by notice it immediately. The location of the store at one of the most important points on Yonge Street, where crowds of people are continually passing, constitutes one of its most valuable assets. The stock within the store is well chosen and very complete. The space given over to demonstration is reasonably large. Attendants are chosen with particular reference to their knowledge of the business and to their ability to entertain a customer who is seeking information. The atmosphere is one of demonstration rather than of pure salesmanship. The desired result is attained equally well, perhaps better.

A third illustration indicates another company's method of conducting an advertising campaign,—by street car advertising. It is an open question whether this form of publicity is as valuable as it has often been considered in the past. Many companies have failed to get results, but evi-



Attractive showing of electric heaters.

dently the question is open to discussion. Where the light and power company is under the same management as the railway company, the reason for such advertising may be more evident.

One of the prominent features of a successful washing-machine and vacuum-cleaner campaign conducted by the Toledo Railway & Light Company recently, was the series of ten large attractive street-car posters furnished by the Western Electric Company. Two of the posters are shown in the accompanying illustrations, taken from the Electrical Review. Their effectiveness is readily apparent.

Five of the posters, which were on the washing machine, appeared in every car in Toledo during the first ten days of the campaign which were devoted to the sale of

Electric sweeper advertising in street cars.

washing machines. The posters were changed in the cars every other day.

The second ten-day period, on vacuum cleaners, was conducted in the same manner as the first, posters of the vacuum cleaner being changed in the cars every two days.

Co-operative advertising work of this character, conducted jointly by the jobber and retailer, is bound to be productive of the most satisfactory results.

Electric Railways

Jitney Operation as a Competitor for Electric Railways—Probable Life Promises to be Short City of Toronto Losing Money on Them.

The jitney fad has struck Toronto. Two causes may be assigned which would appear to justify the operation of this type at the present time in this city. First, the considerable outlying areas not served by any kind of transportation system, and, second, the large number of automobiles and chauffeurs which are known to be more or less at a discount due to financial and war conditions.

In one section of the city, a residential section, the jitney service is operating as a supplement to the street car service three or four hours in the morning and the same in the afternoon, when the residents of this section are returning from down town. This route is something less than a mile and should be a fair test of what the jitney can do in the way of accommodating the public. The service, however, is little more than an aggravation at the present time. On fine bright days people for the most part prefer to walk, and in unfavorable weather the accommodation is entirely inadequate. About three to five street cars discharge their loads of anywhere from twenty passengers up, for every single trip of the jitney, which can carry only six. If a sufficient number of jitneys could be put on this route to anything like meet the demands of the public in inclement weather, such a service would doubtless be much appreciated.

Another jitney route in Toronto, parallels the best street railway service in the city, Yonge Street. Here, during rush hours, there is approximately a two-minute headway by the railway company's best cars, constituting one of the finest street railway services in the world today. Why a jitney should choose this route is difficult to understand, as except at rush hours, the cars are more comfortable, safer and practically as rapid. The advantages of a privately-owned automobile do not apply to the jitney in this case, as a dusty, congested and dangerous route is followed. It must be remembered, too, that the jitney is driven primarily with consideration for the schedule; that is, haste rather than comfort.

City Loses Percentage

Two features of the jitney which naturally present themselves most forcibly in a city like Toronto, are, first,—is the city willing to forego the very handsome percentage of gross earnings which the Toronto Railway Company under its franchise pays, as, of course, the receipts of the jitneys must be practically subtracted from the receipts of the Street Railway Company; and, second, are the patrons of the jitney service willing to forego their guarantee of safe transportation which an established, wealthy corporation gives? Accidents to occupants of street cars are almost unheard of, while accidents to occupants of automobiles are frequent. This, of necessity, is still more marked when the automobile is forced to travel on schedule along congested streets. This is a question not often considered by the patron of the jitney, but is, we believe, of very prime importance.

Quite aside from these considerations, there is the question of whether the jitney service can be made to pay. Many men have established themselves in this business because, perhaps, they find themselves with an automobile or two on their hands, for which they have no immediate use. The question of first cost thus is often not thought of, and indeed depreciation is quite too rarely taken into consideration. There are many users of automobiles who will tell you that the cost of operation of their cars is in the neighborhood of twenty cents a mile, everything considered. With a small car this figure doubtless is high, but nevertheless depreciation is a very formidable factor in the consideration of this question.

Number Gradually Diminishing

In the United States the jitney has had quite a remarkable mushroom growth in the last few months, and though the operations have not been carried on quite long enough to prove by experience what the ultimate results are going to be, the evidence seems to show that, where any considerable number of cars have been placed in operation, this number has been gradually diminishing as the cars, through depreciation, have become unfit for service. The matter is treated at some length in a recent issue of the Electric Railway Journal, and the following quotations will be of interest as indicating what has been taking place in two or three large United States cities. In the city of St. Louis, for example, the authorities have encouraged the jitneys, in that they have not brought them under any kind of regulation. In analyzing the expenses, however, an automobile dealer who has been closely associated with the operation of these machines, finds that even under such favorable conditions, the receipts are much over-estimated. This dealer estimates the tire expense at $60 per 3,000 miles or, in that particular instance, a little less than $2 per day. Gasoline in St. Louis costs only 10 cents and allowing 20 gallons per day, this item is $2. The driver's wage is also $2, making the total expense per machine $6 per day. It is assumed that the income is $10 a day, leaving a net of $4 per day, or $120 per month. Of this amount $60 is allowed for sinking fund to provide against accidents, repairs, depreciation, etc., leaving a net profit of $60, as revenue for the owner of the car. The report goes on to state that quite aside from such minor items as the abnormally low price mentioned for gasoline, low wages for driver, and unreasonably high receipts, this statement constitutes an excellent argument why no one should enter the jitney business. Assuming an average trip of two miles and the extremely high average of three passengers per trip it would be necessary for the jitney to make about 50,000 miles in a year if it is to have gross receipts of $10 per day. This mileage is about what would be obtained from the average private car in ten years, which makes the allowance of $60 per month for repairs, depreciation, accidents, etc., look very much too small. In fact, one accident may wipe out the profit for a whole year.

The average cost of operating in jitney service a Ford

car capable of seating five passengers was stated by representatives of one of the largest distributors in the country to be approximately as follows:

Tires	0.8 cent
Gasoline	1.0 cent
Oil and grease	0.2 cent
Repairs	0.8 cent
Depreciation	0.6 cent
Total	3.4 cents

On a seat-mile basis this would amount to 0.8 cent as the machine offers four revenue seats. If camp stools were put in for two more passengers the cost would be 0.6 cent. This figure, of course, does not take into consideration any such charges as taxes, housing, insurance and accident claims. If, as is indicated by actual records in Seattle, the car makes 100 miles per day and earns $6, there remains only $2.40 per day to pay these charges and to reimburse the driver.

The lack of real profit in the jitney bus is brought out also by the following remarks of M. C. Booth, organizer of the first jitney-bus company in Portland, Ore. The statement was made before the Portland Realty Board and covered actual figures based upon the speaker's experience:

Interest on investment at 6 per cent.	$33 per year
Depreciation on car	150 per year
Current repairs	438 per year
Tires	350 per year
Gasoline and oil	430 per year
Personal liability insurance	200 per year
License	5 per year
Overhead charge	52 per year
Incidentals	36 per year
Total	$1,694 per year

"Gross receipts," said Mr. Booth, "would be $2,190 per year at $6 per day, and deducting $1,694 for operating expenses leaves $495 from which must be subtracted $250 to cover fines, damages to other people's property and to the car in case of accident, as well as attorney's fees for services in the police court, leaving a balance of $245 for the operator's labor for the year.

"The reason why so many have engaged in this business is because they cannot find anything else to do."

The article quoted above goes on to say that the chief cause of the jitney craze has probably been due to the fact that receipts have been greatly over-estimated, and this, together with lack of appreciation of the real operating cost, has undoubtedly been a material factor in inducing owners of cars to enter the business. As an example of the misconception of the real situation it might be said that in St. Louis the daily earnings of a jitney-bus driver have been reported in general at about $10. This fact has been given wide publicity in the daily papers.

However, on February 20 the manager of the jitney-bus association stated with considerable pride that 4,000 passengers had been carried on the day before. This number at 5 cents each would bring total receipts of $200 for the day. Reference to the daily papers shows that there were twenty-two motor cars in operation and two motor buses each with a carrying capacity of thirty. Assuming that the motor buses, with their large capacity, brought in a proper proportion of the receipts, or say $30 each, there would be left $140 to be divided among twenty-two cars. This indicates average receipts for each motor car of $6.40 a day. In addition, it is quite possible that the figure of 4,000 passengers was somewhat exaggerated.

In Kansas City the same peculiar discrepancy between reported receipts and actual possible receipts may be noted. A newspaper report of February 10 states that 35,000 passengers were carried on February 9, bringing in a total of $1,750. Two hundred jitneys were registered as belonging to the jitney operators' association, and the unregistered drivers were estimated at nearly a hundred more. Assuming that the actual number of jitney operators was 250, the receipts per car came to less than $7. Even neglecting the unregistered drivers the receipts divided among the two hundred registered cars amounted only to $8.75 each.

In Peoria, Illinois, one of the jitney operators estimated that his average day included 25 trips with an average of five passengers a trip, making $6.25 income for the day. This driver had a seven-passenger touring car and he estimated the expense of operating it at about $1 per day, thus making, as he expressed it, "an easy profit of $5 per day for the chauffeur." The length of this driver's route is not known, but if it was more than one mile, his alleged expenses of $1 included only gasoline and did not give any consideration to wear on tires, repairs, depreciation and the like. With such misapprehension of the real facts in the case, it is not difficult to see why numerous owners of cars have been induced to take up the jitney bus as a means of livelihood.

Equipment of One-Man Cars Solving Operating Expense Troubles in Several Cities—Gradual Introduction into Canada

The operation of electric railways on a financially-paying basis, especially in localities where the growth of population has not kept pace with expectations, has led to the adoption in a number of smaller places throughout the continent of North America of one-man electric cars. At different points in Canada, this scheme has been tried out with success. The cost of wages is thereby greatly reduced and, except where the route has been congested, little difficulty has been experienced in handling the traffic. It has been noted, however, that the practical doubling of the work of the motorman has called into play extra qualifications which the average operator may not possess, so that this type of street railway operation calls for a better type of employee and consequently one that can demand a higher wage. Where the operator is efficient, however, and seized with the importance of the position he occupies and the necessity of keeping terms between his employer, whether municipality or private individual, and the public, the system has worked out with very great satisfaction.

An interesting paper on this very question was recently read by Mr. R. M. Howard, general manager of the Minnesota division of the Wisconsin Railway, Light & Power Company, in Winona, before the Wisconsin Electrical Association. Mr. Howard has had three years' experience with the new type of car and outlines in his paper the advantages and savings experienced by his company. His evidence is favorable to one-man operation and hence is interesting to a number of Canadian railways of the smaller class, which at present are operating on an exceedingly close margin. The following quotations are from Mr. Howard's paper:

Experience with the One-Man Electric Car in a Small City

"The operation of the Winona Railway from its electrification in 1891 to 1911 did not yield operating expenses. In August, 1911, the property changed hands, and as the result of a number of improvements the gross earnings increased more than forty per cent. with only a temporary rise in operating expenses. The service was then as good as could be reasonably expected in a town of 20,000. Careful study showed that no further opportunities for important reductions in operating expenses were available except by the adoption of one-man near-side cars.

"The company realized, however, that the co-operation of both the public and employees would be necessary before

such a system could be introduced successfully. The matter of buying one-man cars was therefore laid before the local City Council and commercial association, and the economies to be effected were frankly admitted. Photographs of the proposed cars and a description of their equipment and operation were submitted, upon which the proposition of the company was approved and it was urged to go ahead. An order was then placed with the St. Louis Car Company for four new cars and for door-operating mechanisms to equip the old cars retained for one-man service. In all, eight cars are now operated on regular schedule.

"The new cars are of double-end type, 34 ft. 10½ in. over the bumpers, with 6-ft. 3-in. vestibules and an opening 5 ft. wide at the entrance and exit sides. They have steel underframes, steel sides and arch roof, are mounted on St. Louis No. 46 trucks of 8-ft. wheelbase, and are heated with Smith No. 3 hot-air heaters. The controller and brake staff are mounted to the left of the usual location to place the motorman out of the way of entering passengers. The register cord is also located to permit the motorman to ring up fares without moving from his operating position. The entrance and exit vestibule steps of folding type are operated from levers placed between the controller and brake rigging. The electrical equipment consists of two GE-54 motors with K-10 controllers. The old cars measure 29 ft. over all, but have vestibules only 4 ft. 6 in. long with entrance and exit door openings of 26 in. These cars were remodelled for the one-man operation, including the addition of push-buttons and the removal of the bulkhead doors.

"For ten days prior to inaugurating the new system the company displayed in the daily papers and also distributed on the cars in dodger form an advertisement which explained the reason for the adoption of the new system, including a frank statement that the earnings did not justify new two-man equipment. Each trainman also received typewritten instructions covering the operation of the new cars, including the registration of fares, issuance of transfers, etc. Fares must be paid before the passengers enter the car, but transfers are issued to passengers as they leave the car.

One-man operation began on May 3, 1914. As the public was well informed regarding the change, the new system went into operation without a hitch. No difficulty has arisen in maintaining the average schedule of 9 m.p.h., but if loops for turning cars at the ends, air brakes and air-operated doors were used an operator could doubtless make faster schedules if traffic conditions so demanded.

Performance with One-Man Cars

"After one and a half months the company saw what one-man cars could do for heavy traffic. The earnings on July 15, 1914, were the largest in its history, exceeding the previous record by 90 per cent. The average earnings for that day were 41 cents per car-mile, the largest number of fares on a single trip 126 and the turn-in from one man, $70.50. Operation on this day was a little slow because all fares had to be collected before the cars were started, but not a step accident occurred. In any event such heavy days form too small a percentage of the yearly operating period to offset the expense of conductors. Railroad crossings are flagged by the motorman in the usual manner, but the saving in the wages of conductors would warrant the maintenance of flagmen on one or two crossings if local conditions made this necessary.

"The operation of both the new and remodelled cars has produced the usual operating advantages of eliminating step accidents, because the doors are not opened or closed while the car is in motion; of avoiding arguments regarding payment of fare and of easier checking by inspectors because fares are registered as passengers enter. Further, the one-man system has greatly decreased the extra list. The percentage of trainmen's wages has also decreased from 29 per cent. to 19 per cent. of the gross revenue, so that an increase in wages would not affect so materially the ratio of operating expenses to gross income. The apparent discrepancy in the percentages quoted is explained by the fact that the conductors did not work to the end of the line but turned back at the last switches. Hence their hours did not equal those of the motormen.

"The total expense of rebuilding old cars and purchasing new cars was $11,893.55. During the first seven months' operation a saving of $3,549.02 was effected. On the basis of equal mileage for the corresponding period of 1913 and 1914, the difference in the ratio of operating expenses, insurance and taxes to gross earnings is 10.52 per cent. in favor of one-man operation. If the two-man system had been retained the net earnings would have been 38.67 per cent. less. The savings effected during the first twenty-six months will amortize the entire investment. Only the investment in car bodies and trucks has been considered in the amortization statement because a company which operates old motors can amortize the investment for new motors by applying the saving in motor maintenance cost to the purchase of new motors.

"The company's experience has led it to the conclusion that it would be a mistake to remodel small short platform cars and attempt to put the one-man system into operation with such equipment only. At least part of the equipment should be modern with long platforms especially designed for one-man prepayment operation. When all is said and done, the public is the final arbiter and the question is too important to risk the chance of failure due to the lack of proper equipment. If platforms are long enough and the motorman attentive and courteous, the system is bound to be satisfactory from every standpoint. Few street railways can afford to spend anything more than is absolutely necessary, and the one-man car will often place the balance on the right side of the ledger."

Detroit United Purchase

A special meeting of the stockholders of the Detroit United Railway Company has been called for March 31 to take action on the proposal of the City Street Railway Commission to assume, with the approval of the electors, bonded indebtedness of $24,900,000 in exchange for the lines of the company within the one-fare zone. It is understood that the board of directors is inclined to recommend that the city's offer be accepted. The announcement of the commission's proposal to purchase has already called forth numerous attacks upon the plan, and in the event that the commission and the company reached an agreement a bitter fight is sure to occur before the proposition reaches the public. There are many legal questions involved which must be adjusted before the matter will be in shape for presentation to the electors; in fact it is held by several legal authorities in communications to the newspapers that charter amendments and special action by the Legislature will be required before the city is empowered to assume the company's bonds. The commission is now giving most of its attention to the legal phases.

A deputation from a number of Ontario municipalities interested in hydro radials waited on the Provincial Government on Friday, March 26th, asking a subsidy of $3,200 a mile, for any roads built.

A deputation representing the Ontario Hydro Radial Union, which recently interviewed Premier Borden with reference to legislation covering the granting of a mileage subsidy, did not meet with encouragement for immediate assistance. The Premier, however, promised that he would submit the question to his colleagues and that it would receive full consideration.

The Dealer and Contractor

Art and Science in Home Lighting—A Vast Difference Between Quantity and Quality—Marked Physiological Effects of Badly Installed Lights—Every Householder Should Have Expert Advice.

By George W. Cassidy*

The proper lighting of the home has become a very important subject in recent years from two standpoints, namely, the aesthetic and the scientific. A broad and comprehensive knowledge of both these phases is required if satisfactory results are to be obtained in practice.

To illuminate a home properly, the lighting must be considered from the aesthetic, physiological, psychological and economical standpoints. From that old saying, "a man's house is his castle," one knows that every man desires to have his home as beautiful as his means will afford and as his taste dictates. Therefore the primary requirements are that the lighting should be aesthetically correct; the fixtures should be designed to harmonize with the decoration of the respective rooms. Most homes to-day have lighting fixtures which are aesthetically correct.

In taking up the second consideration one is confronted with an entirely different condition. How many homes even approach being correctly lighted from the physiological standpoint? The change in the type of illuminants in the last few years has placed a much greater emphasis on the physiological side of the question not only from the increase in intensity of the light, but also from the decided change in color. Instead of the soft yellow light of the carbon lamp, one must now contend with the hard, cold white light of the tungsten lamp. This point was particularly forced on my attention while I was walking through some of the prominent streets of my home town when I saw the large number of houses which were lighted with brilliant and glaring tungsten lamps. If these lamps were not of the frosted, ball type, they were shielded by some form of frosted shade which is a good medium to show just where the filament has its brightest point. From an ocular hygienic standpoint, it is very easy to understand why a great majority of the people of to-day are compelled to wear glasses and why there is so much suffering from eyestrain.

The third consideration, the psychological, is also of great importance, for it has to do with the effect light has on the mind. I will not take time to go deeply into this phase of the subject. However, there is no question that certain kinds of lighting will, as the saying goes, "get on one's nerves." For illustration, the improper use of semi-indirect or direct lighting in the home. One's first impression on entering a room lighted by either of these systems is the lack of glare; but after sitting in the room for a while one often wonders why the ceiling seems so low; or why a beautifully carved table or chair does not seem to have the proper perspective, for the slight shadows they cast are from an unnatural angle; there is a spectral look to the objects in the room. In other words, the whole room looks flat; it lacks the correct balance of light. I will later explain this effect in a specific case.

It is also a known fact that color is an important factor from the psychological standpoint and applies particularly to white lights. Just how the nerves or mind are affected is a question that comes within the province of the psychologist. Personally, I know of a number of cases where the effect of white lights, I mean white light of the ordinary tungsten lamp, concealed in ground glass shades, has caused the person to be depressed or have the blues.

In lighting a house the problem should be taken up first from the practical side and not the artistic or aesthetic. Often the outlets are placed without regard to the purpose for which the room is to be used. It is very important to study the specifications carefully, to learn the area of the room, the height of the ceiling, the general decorative scheme and particularly the purpose for which the room is to be used. Knowing the use of the room, one can readily decide upon the foot-candle intensity, place the outlets, and determine the proper amount of wattage, etc.

I have tried to describe in a general way the most important principles which should be borne in mind when a problem of home lighting is being considered. For a more comprehensive understanding of a number of the points already mentioned, it will be better to mention the actual conditions encountered by giving a particular case: the proper lighting of a modern suburban or country house costing from $5,000 to $15,000. Such a house usually has an entrance hall, living room, den or music room, dining room, kitchen and pantry on the first floor and sleeping and bath rooms above.

Entrance Hall

Frequently this room is given little or no attention as far as correct lighting is concerned—"just a light," many owners seem to think is sufficient. And yet one's first impressions of a home are obtained from the appearance of this room. Very often the first thing to be seen is the typical hall lantern with its glaring lamp. I do not think I exaggerate when I say that a very large percentage of all houses to-day have halls lighted in this manner.

Suppose the following specifications for this hall: dimensions 16 ft. long, 10 ft. wide and 9 ft. 6 in. high, with colonial treatment. The stairway is situated at the rear end. The woodwork is to be white with medium colored walls and light buff ceiling. The first question to determine is the approximate intensity of the illumination required. There should be an intensity of at least 1 to 1.5 foot-candles. Uniformity here is not at all necessary; however, there should be no dark corners. The amount of light required will be determined by the color of walls and ceiling, and the absorption of the glass employed. Having determined the light intensity, the position of the outlet is the next problem. In this particular case there should be one ceiling and two bracket or side-wall outlets. The ceiling outlet should be in the middle of the room and the side outlets arranged to balance properly. For economical reasons the

* Extract from paper read before New York Section, Illuminating Engineering Society.

ceiling outlet should be wired for two circuits; one for the night light and the other for general illumination. For convenience the lamps should be controlled from the second floor as well as from the first floor.

To illuminate this room and stairway efficiently from a single ceiling outlet, it would be necessary to increase the power of the illuminant to a point where the intrinsic brightness would be very annoying. By distributing the lighting units and using smaller illuminants shielded by properly designed shades, made of tinted diffusing glass, or by amber colored lamps, the glare would be reduced to a minimum. With this foundation, the designer or decorator, can readily design fixtures which will harmonize with the period or decoration of the room.

Living Room

In lighting this room, there are several very important points which have a bearing upon the success of the lighting scheme. The first and most important is this: here the family lives and in the evenings they must live with the lighting provided. In a great many cases this seems to require an effort.

Suppose the following specifications are those of a typical living room: dimensions: 24 ft. long, 18 ft. wide and 9 ft. 6 in. high; wood trim of Flemish oak; walls a medium brown, and ceiling light buff. I have already placed emphasis upon the fact that the purpose for which the room is to be used is very important. The living room is used for several purposes; therefore the lighting scheme must have flexibility. In addition to being the library of the home, it is often used for festive occasions. There are other times when members of the family simply desire to sit around and converse. To meet these conditions it is necessary to supply at least three different lighting arrangements. In placing the outlets the decorative arrangement must not be lost sight of, even though a compromise is necessary. In order to keep the intrinsic brightness reduced to a minimum there should be two ceiling outlets, one in the centre of each half of the room. This arrangement will give a more even distribution of light and a decided reduction of glare.

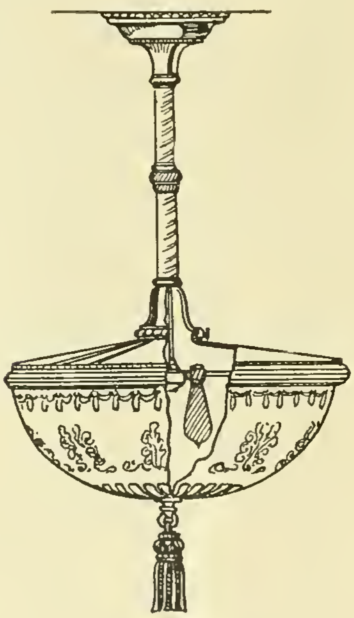


Fig. 1

With a light intensity approximating three and a half foot-candles, a high general illumination is assured which will suffice for card playing, dancing and special occasions. For average conditions a one and a half foot-candle intensity will be enough. In order to accomplish this in the best way, each fixture should be wired with two circuits, the higher candlepower lamps on one and those for the lower intensity on the other.

Before considering the type of lighting fixture to be suggested, it will be well to briefly define the three forms of illumination in common use at the present time, namely, direct, semi-direct and indirect.

A direct lighting fixture throws most of its light directly to the floor and walls; only a small percentage of the light reaches the ceiling. A semi-indirect fixture reflects the greater percentage of its light to the ceiling from which it is diffusedly reflected downward; a smaller percentage of the light passes through a glass or translucent bowl. An indirect fixture reflects all the light to the ceiling from which it is diffusedly reflected over the room.

Consider first the usual semi-indirect lighting unit. The height of the ceiling being 9 ft. 6 in., the maximum distance of the top of the bowl from the ceiling cannot exceed 2 ft. 4 in. because with a bowl 6 in. deep the fixture would hang 6 ft. 8 in. from the floor. From the aesthetic viewpoint, this type of fixture in this room would be bad practice because the distinctly bright spots over the fixtures would be the most conspicuous points in the room. With a ceiling 11 or 12 ft. high a semi-indirect fixture or an indirect fixture with a luminous bowl can be hung far enough below to give a wider and more even distribution to the light and thereby overcome the objectionable effects of light spots. This defect could also be softened and the light balance restored by the use of one or more table lamps or by incorporating side brackets in the decorative scheme. These same objections would apply to the indirect unit.

Aesthetically, the use of the indirect fixture in the home is incorrect unless designed with a luminous bowl; otherwise, with the opaque bowl, the body of the fixture forms a very sharp contrast with the lighted ceiling.

The most commonly used fixture in living rooms is a direct lighting type of the multiple unit or shower design. The glass manufacturers have put on the market a great variety of shades to be used on fixtures of this type. They have recognized the fact that by artistic etching and tinting, in the ivory tones, they have been able to produce an article which is effective and at the same time eliminates an appreciable amount of the glare, and there is no question but that the results obtained by the use of this glassware is a step forward. These shades should be long enough to conceal the lamp. Considerable caution must be exercised also in the selection of illuminants. If the conditions are such that a high intensity of light is required as in the present case, the filament of the lamp will be visible as a distinctly bright spot on the shade owing to its closeness to it.

Compromise

I have now described three different types of fixtures and apparently without arriving at a satisfactory result. Therefore a compromise suggests itself: the blending of the desirable features of direct and semi-indirect lighting. By designing a fixture of the glass bowl type, equipped with an opal cover, one may obtain a unit which will transmit a soft diffused light to the ceiling without spotting, while a good percentage of the direct rays will pass through the bowl. See Fig. 1. By reducing the ceiling illumination and utilizing the direct rays, the effect of flatness in the room may be avoided and the natural perspective and shadows of objects retained. Care must be taken in placing the lamp within the bowl to have the filaments sufficiently distant from the side to prevent the appearance of bright spots and to permit the light to be properly diffused through the glass. Glass affording a maximum diffusion and the minimum of absorption should be used. This type of fixture will overcome many of the defects which are objectionable from a physiological standpoint. Artistically and psychologically it is still

defective, in that the room lacks color and a correct balance of light. By this latter term I mean a distribution from other sources in the room such as softly lighted lamps on side brackets or portable lamps so arranged or placed as to bring out the important points in the scheme of decoration. Supplemental lighting is of course more or less extravagant, and where economy is essential it can be omitted with possibly the exception of the table lamp.

I have mentioned in a general way the desirability of the use of color in the lighting of the home. It is regrettable that more emphasis has not been placed on this part of the problem by those interested in artistic lighting and also those who approach lighting problems from the engineering side. I have heard and read statements made by lighting experts that the ideal artificial light is that which most closely resembled natural daylight in color and diffusion. I consider this statement entirely too broad and in need of qualification. Daylight is the ideal light medium in all manufacturing pursuits, office work, draughting, color matching and many other commercial enterprises. I may be making a rather radical statement when I say that daylight as it comes from the heavens is not the ideal light for lighting the home. The really artistic home should be aesthetically lighted under daylight conditions as well as under artificial light. The interior decorator studies his problem from many angles, two of the principal ones being light and color; and if daylight is the ideal light, why does he use so much color in the window hangings, portiers, etc., and at times even shut it out entirely? It is to improve upon daylight, to obtain color and pleasant lighting effects and shadows. Therefore, if daylight lacks color, and artistic warmth, why should one strive to imitate it for the home. The present illuminants have already reached beyond the limit of good light for home use and need modification for the best results.

There are available several materials suitable for producing color effects in decorative lighting such as silk, gelatine and glass. I have been informed that one of the large lamp manufacturers has already perfected a method by which regular sized lamps can be made of amber colored glass and put on the market as standard lamps.

I have said that the fixture I have described as the most suitable for the requirements of the living room lacked color. Ophthalmologists and oculists have agreed that amber light is preferable to other colors. By tinting the glass bowl a yellow tone, and by the use of light amber glass lamps or color caps on incandescent lamps giving white light, it is possible to produce the soft warm and hospitable effect so necessary to bring out the real fineness of the decorative scheme of the room.

Ocular Hygiene a Prime factor

The practical engineer will in all probability say that such a scheme sacrifices economy. This is true, but economy is of secondary importance when compared with the artistic results and ocular comfort. Ocular hygiene may well be a primary factor in the lighting of living rooms. It is unfortunate that there are so few table lamps on the market to-day which combine the scientific and the aesthetic requirements. Many of these lamps are artistic; some few scientific; but a combination of the two is almost wanting.

As demonstrating more clearly the important points necessary to be borne in mind when designing an efficient table lamp, Fig. 2, I believe, meets the requirements of a living room. It possesses the three essential features of good lighting: first, it is artistic; second, it is efficient as a reading lamp; and, third, it has flexibility. By turning one switch, one may connect indirect light which evenly illuminates the whole ceiling with a soft amber glow. By the turn of a second switch, two more lamps illuminate the silk shade which diffuses a soft light over a large area of the floor. This is necessary to give the correct balance of light in the room. Under daylight conditions most of the light coming through the windows is distributed on the floor and there is a balance between the brightness of the ceiling and that of the floor. This is the natural condition of light direction which mankind has been accustomed to for generations. With a third switch the two remaining lamps which are utilized for reading purposes may be lighted. These switches also conduce to economy in the use of the lamp. In selecting the mirror reflector for the indirect light equipment, I have taken the concentrating in preference to the distributing type, because the amber colored disk will distribute to a certain extent. Care must be taken to prevent the light distribution from going beyond the stop line. In most rooms this would be at the picture moulding; and, where this is omitted, the proper line would be at the junction of the wall and ceiling. In the arrangement of the direct lamps the filaments are so placed that the highest

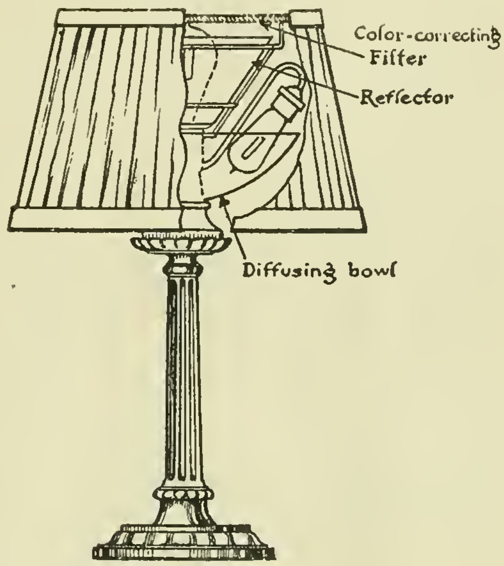


Fig. 2

point will form the apex of a right angle with a line drawn from the maximum reading distance which is approximately three feet.

The diffusing shade which is made of alabaster acided glass is so designed that its general curvature is somewhat parallel with the filament of the lamp. This is necessary to assure the greatest efficiency of the diffusion as no reading lamp is efficient without such diffusion. If the light rays are not diffused either by the interposition of the proper kind of glass or by indirect reflection from a light colored non-glazed or mat surface, specular reflection from the book or paper which one may be reading is bound to cause eye-strain.

Den or Music Room

Suppose the specifications of a room are 14 ft. long, 12 ft. wide and 9 ft. 6 in. high; medium dark walls and light buff ceiling. A room of this type can be correctly lighted by a table lamp similar to the one described in the lighting of the living room. Fixtures or bracket lamps are not required but the use of wall lamps may enhance the decorative treatment. If used they should be equipped with lamps of very low candle-power, not over 10 watts; and in selecting the light shields, whether of glass, silk or other fabrics, a low translucency is essential. If the room is used as a music room, it is only necessary to increase the size of the illuminant of the indirect portion of the lamp to obtain the proper amount of illumination. If for economical reasons

this is not practical, the lighting scheme must be supplemented by a properly designed local light at the piano.

Dining Room

I approach the problem of what constitutes correct lighting of the dining room with considerable reluctance. I presume that of all the rooms in the house the dining room is lighted by the most diversified methods. There is no question about the flexibility of the lighting arrangements in this room.

Specifications: dimensions, 18 ft. long, 15 ft. wide and 9 ft. 6 in. high. Ivory colored woodwork, medium straw colored walls, and light buff ceiling. Architecturally, such a room may be called colonial. I have mentioned the color scheme to demonstrate the direct relation between the lighter or darker colored walls and ceiling and the light intensity. Dark toned rooms absorb more light and therefore require a higher candlepower in the illuminant. The placing of the outlets depends upon the system of lighting to be installed. Decorators and architects have used with success, from the artistic as well as the good lighting standpoint, side brackets around the room, the light source being properly shielded and supplemented by a candelabra on the table. A room of the dimensions given would require at least six two-lamp side brackets having low candlepower lamps of not over 10 watts each. This would give a fair general illumination without annoying glare, but it would be necessary to have them all lighted or there would be dark corners or spots upsetting the aesthetic effect and also spoiling the correct lighting scheme. This arrangement would not be economical in the moderate priced residence here considered.

Another method of lighting a dining room which has been very extensively used is the so-called glass dome fixture. This is a fixture designed with a large glass dome suspended by a chain or stem over the table. From the decorator's point of view it is particularly bad. It breaks into the symmetry of the room and lacks proportion to its surroundings. It is the most conspicuous object; it occupies a position which compels it to dwarf everything around it; it also prevents the artistic arrangement of floral decorations. From the physiological side the dome lighting fixture is far from desirable. The table cloth is so brightly lighted that there is a decided glare. A very simple experiment will demonstrate this point. If the cloth is suddenly removed from the table, the effect will be as if some of the lamps had been extinguished, for the room will seem almost dark. The table cloth has acted as a diffusing medium for the direct light under the dome. If doilies are used instead of the cloth, one is likely to be troubled with specular reflection from the polished surface of the table. It is possible to reduce the extreme brightness upon the table by the use of some diffusing medium such as a silk disk, but even with this precaution, the glare is not entirely eliminated because the source of illumination is so near the surface of the table.

Another objection to the use of the dome fixture is the fact that those seated at the table are constantly looking from a light to a dark zone and vice versa. Each change of the direction of the gaze under such condition causes continual dilation and contraction of the pupil with its consequent visual fatigue. This defect can be overcome, of course, by the use of side brackets or ceiling fixtures, but the addition would not be economical.

As the specifications of this dining room do not call for a beamed ceiling, one might place the outlet in the centre of room and install a semi-indirect or indirect fixture to suit the conditions.

As the ceiling is 9 ft. 6 in. high, and because the light source is placed over the table, it is possible to hang the fixture only 5 ft. 6 in. from the floor. This would leave sufficient distance between the ceiling and the top of the bowl to permit of a wide distribution of the light and eliminate light spots on the ceiling. This overcomes the artistic defects apparent under the other conditions. By the use of an amber colored disk over the bowl of the fixture, the white light from the tungsten lamp may be changed to soft warm tones, which will improve the beauty of the artistic scheme of the room. To eliminate whatever flat effect of diffused lighting may exist, it is only necessary to add outside direct light units arranged around the glass bowl of the semi-indirect fixture or the opaque bowl of the indirect fixture according to the taste of the designer. This addition will correct the light balance by giving to the surroundings light and shadow. In providing against the physiological defects of such a fixture, thought must be given to the design and color of the glassware or silk. The glass should be properly tinted with a yellow tone and if silk is used amber and champagne colors are preferable. Care must be exercised in lamping the fixture. The outside direct lamp units must not exceed 10 watts, while the inside lamps must be larger but not to exceed 60 watts. By this arrangement the centre lamp will give the necessary general illumination and the outside lamps the supplementary. For the sake of

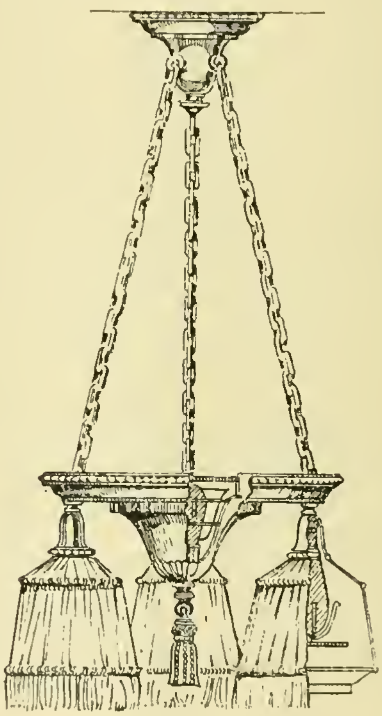


Fig. 3

economy it is a good plan to have the wiring for two circuits. In clearing or setting the table it is not essential that all the lamps be lighted.

In the design of the silk shade of the lamp which I have shown, considerable compromise has been made. In the purely technical design, the line representing the side of the shade should form a somewhat wider angle so that the side of the shade would be parallel to the line of vision of the average height person sitting at the table, to avoid the possibility of any glare. The flange at the bottom leaving a 1 in. opening prevents a person seated at the table from seeing the lamps and the glare from the reflecting surface.

The lamps within the silk shades are equipped with amber colored disks and as a result a beautiful soft warm light is cast evenly over the table. The opaque bowl contains the indirect lighting equipment over which is placed an amber plate. This type of fixture combines general illumination with the local lighting over the table and at the

same time adheres to the important principles of good lighting.

The Kitchen

Where service lighting is required, such as in kitchen, pantry, etc., fixtures placed as closely as possible to the ceiling, and therefore above the line of vision, are recommended. The shades, preferably opal glass frosted on the inside and of the distributing type, should be about 7 or 8 in. in diameter and with depth enough to hide the lamp. In some instances a side wall lamp is required; in that case the bracket should be equipped with a rather dense opal glass, deep enough to cover the whole lamp, the lamp, of course, being placed up or down, according to the position of the outlet.

Regarding the proper lighting of a bed room, efficiency and economy are the essential features to be considered. By placing one outlet in the centre of the room and one over the dresser, it is possible to obtain good results. A fixture placed close to the ceiling, having a lamp housed in an artistically etched and yellow tinted distributing type of shade, from 7 to 8 in. in diameter with sufficient depth to cover the lamp, is often quite satisfactory. The interior of the shade should have a roughed or mat surface in order to diffuse the light properly. As the fixture is placed well above the line of vision and the distance between the filament of the lamp and glass will be sufficient to eliminate spot glare from the filament, good general illumination without glare and at the lowest cost will be obtained. The fixture can be artistically designed and installed at a very small cost. The dresser light should be suspended over the middle of the mirror and 10 to 12 in. in front. Five feet ten inches from the floor is the average height for a fixture of this type. This, however, is more or less optional according to the conditions. In the main, the specifications of the ceiling fixture will apply in this case, with the exception that the shade, if made of glass, must be so tinted as to prevent glare. This is very important as the shade is directly within the line of vision. A silk shade is preferable to a glass one for this reason, as well as for the better artistic effect. As the light is directly from above, a woman will have no difficulty in arranging her hair according to the latest vogue. The light being well diffused within a considerable range, there should be no difficulty in seeing well.

Bathroom

There are one or two points in regard to bathroom lighting, especially interesting to the man of the house, which it is well to mention. Most bathrooms in moderate priced houses have medicine closets with mirror doors. The men members of the family use this mirror when shaving. A large number of people do not know that in order to see well before a mirror by artificial light the mirror should be in shadow, so that the face will receive the greater flux of light. By having a bracket outlet placed on each side of the medicine closet and approximately 5 ft. 6 in. from the floor, which is the average height of a man's face, the light source will be in a line with the face and the best results from the light will be obtained. The shades should be of some good diffusing glass about 5 in. in diameter, deep enough to shield the light source, and hemispherical in design. This type of bracket unit may be termed semi-indirect as the larger percentage of the light is reflected to the wall and ceiling and serves for the general lighting of the bathroom.

I have tried in this paper to add the scientific element to that of the aesthetic in the lighting of a moderate priced house and to show how one modifies the other. The results illustrate a statement in the beginning of the paper that good home lighting is more or less a compromise.

What Does "Concentric" Wire Mean?

To the Dealer and Contractor—Smaller Capital Expenditure and Much More Business—Samples Now Being Tried Out on This Continent

The Committee on Wiring of Existing Buildings of the National Electric Light Association, recently met the members of the Committee on Reducing the Cost of Wiring of the National Electrical Contractors' Association to discuss matters of common interest. The question of the general use of concentric wiring was discussed and Mr. S. E. Doane presented some very interesting data.

The members of the National Electrical Contractors' Association are naturally interested in investigating whether the general use of this wire will prove satisfactory on this continent, as it should be a means of reducing the cost of the average installation. On the other hand, manufacturers are loath to undertake its production on account of the extra expenses entailed, until they are satisfied that the use of this wire will become general. It is understood that this wire has been widely used in England and on the continent with entire satisfaction. That it will be given an extensive try-out on this continent, there seems little reason to doubt, as a number of the larger manufacturers are reported to be already making up sample orders. At this meeting, Mr. Doane presented a very interesting outline of the evolution of concentric wiring, from which the following are copious extracts:

Electric wiring has been developed along two different theories. The original idea was to have a very considerable insulation which should be so strong and so substantial that every danger to life and property should be removed by the large safety factor of the insulation itself.

At a later time and paralleling this theory, another theory was developed along almost opposite lines. The insulated wire is surrounded by a grounded metallic tube. In this case a very substantial and heavy insulation is no longer as essential as under the first theory. Even in case of the insulation becoming insufficient, danger to life and property will always be averted by the interposition of the grounded continuous metallic tube. In order that any danger should arise from a system of that kind, two accidental damages must occur at the same time, to wit: the ground of the surrounding conduit must be bad and the insulation of the wire must be injured. To obviate this the National Electrical Code provides that the conduit must not only be continuous from outlet to outlet, but also mechanically secured in position, and that the metal of the conduit must be permanently and effectively grounded. Furthermore, it is ruled that metal conduits must have the ends provided with bushings so as to protect the wires from abrasion.

Rule 28f permits, however, short sections of conduit to remain ungrounded. If in such an ungrounded section or in a conduit system the grounding of which has become insufficient, the insulation becomes bad, either by abrasion or by condensing water collecting inside the conduit, the conduit may become alive and danger to property or life may arise.

A logical step to obviate this would be to make the conduit tight-fitting with an appropriate filling material—for instance, jute—to preserve the circular section of the conduit.

Fig. 1. This close fit prevents any collection of water inside the conduit. At the same time it obviates any possibility of abrasion, the insulation and the conduit being essentially fixed in their relative positions. The conduit will then advantageously have a certain degree of flexibility to make insulation easier. We thus arrive at the so-called "Kuhlo" or "Stannos" wiring systems, or rather at their first stage, with protective sheath. This variety is used where neither of the poles of the system is grounded.

In central stations with a grounded neutral wire we can go one step further. As the grounded conduit and the grounded neutral wire have no, or at least only negligible, differences of potential between each other, such as may arise from the voltage drop in the neutral wire, it evidently is unnecessary and therefore wasteful to insulate the neutral wire from the conduit as heavily as the potential wire. The insulation material used for the insulation of the neutral wire may be either saved entirely without decreasing the factor of safety, Fig. 2, or it may be put on the potential wire inside with a corresponding increase of safety, Fig. 3. This results in a grounded continuous conduit and a grounded bare wire running inside the conduit. There is no reason why these two conductors, both grounded and both continuous, should not be united into one; in other words, why the conduit should not be used as a return circuit. The idea of using the conduit for carrying the current of the grounded


Fig. 1


Fig. 2


Fig. 3


Fig. 4

return circuit is not new and has been used for many years with ordinary rigid-steel-conduit wiring. The difference between this idea and the concentric wiring is the fact that in the latter the conduit is close fitting (thus leaving no space for the accumulation of water) and flexible to a certain degree.

This is the logical evolution of the so-called concentric wire, as shown in Fig. 4. The potential conductor is surrounded by an insulating coating which in its turn is surrounded by the tubular grounded outer conductor for the return circuit. For mechanical reasons the insulating coating is covered by paper or braiding, which acts as a slip member between the insulation and the sheath in case the wire is bent.

It should not be lost sight of that this system is not a new, untried thing, but was developed five or six years ago. Many millions' worth of this material is now being sold abroad every year.

The advantages of bare concentric wire and the opportunities offered of increasing the business of the manufacturer, central station, dealer and contractor alike, were dealt with recently by Mr. R. S. Hale, chairman of the N. E. L. A. Committee on Wiring of Existing Buildings before the Kilowatt Club of Brooklyn, and reported as follows in the Electrical World of recent date:—

Mr. Hale reviewed the history of the movement for lower-cost wiring, describing successful installations in Europe as investigated by Messrs. S. E. Doane, E. W. Lloyd and himself, and pointing out the relatively small development in this country along the lines of electrical service in old buildings. In New York City less than 10 per cent. of the residences and apartments, with the exception of expensive elevator apartments, have electric service; in Chicago less than 16 per cent. of the single dwellings and only about one-third of the apartments have service, and in Boston it is estimated that there are 160,000 unwired houses and apartments, and these are being equipped at the rate of only 3,000 per year at present. He discussed the successful rise of the unit price system in house wiring, through agreement between the central station and wiring contractors, on the basis that such prices shall neither be so high as to check business nor so low as not to give a fair profit to the wiring contractor after allowing for any saving he may make in selling expense and bad debts.

In certain European cities, notably Strassburg and Milan, the development of central-station customers exceeds that of Brooklyn, though with less than one-third the population. Gas is even lower than in America, 60 cents to 70 cents per 1,000 ft., and electricity is higher. In Strassburg it is practically 10 cents, and the customer has in addition to pay for all his lamps and meet a government tax on each lamp, and further has to pay meter rent, which would make the net rate roughly 100 per cent. higher for the small consumer than here. In these cities the class of people that live on wages of $10 and even $5 a week use electricity as customers of the central stations. Mr. Hale outlined the use of bare concentric wiring in these cities and pointed out that even insurance companies abroad are wiring their offices with this type of equipment. On account of the numerous varieties, it was thought best not to ask to have the National Electric Code changed so as to let all these systems into this country, but instead to get at least one manufacturer to present one of the systems to the Underwriters here to be tried. The work of the General Electric Company in experimentally studying the bare concentric system has been particularly helpful. As a result of recent work along these lines, it has been decided to offer the new section of the proposed wiring rules as an experimental code by which actual field experience can be attained under proper supervision and reports.

Effect on Wood and Metal Moulding

The new wire will undoubtedly be a severe blow to both wood and metal moulding, since it can be used in nearly all cases where moulding is now employed and will, in the estimation of Mr. Hale, be much cheaper, safer and less conspicuous. The investment in tools and plant for making wood moulding is not important, at least as regards moulding for electric wires, while the metal-moulding manufacturers will probably find that many of their fittings can be used for the new wire with but slight changes and that their factories, many of their tools and their organization can be used for making and selling new wire without great expense for the change-over. It is not believed by the author that the new wire will interfere with the sale of conduit, which is extensively used abroad and is more applicable than bare concentric wire to new buildings. The field for the new wire will be almost exclusively in buildings that would not be wired at all if conduit were obligatory, and will give an impetus to the industry as a whole which will lead to the use of more conduit than ever. Other manufacturers are taking up the matter with interest, and the adaptability of the wire to existing fittings renders it likely that before long the less expensive fittings that the new system makes possible will be developed and made available. Tentative specifications and prices have already been made by a prospective manufacturer of bare concentric wire to be placed on the market in competition with existing equipment.

Restrict Use to Branch Circuits

After describing the main features of bare concentric wire, Mr. Hale suggested that for a time the new wire will be used only for branch and tap circuits, but in time it may be used elsewhere. It will probably not be used in new buildings for some time, but only in old buildings where open cleat wiring is not desirable and where the cost of

concealed wiring is prohibitive. It looks now as though the cost of the wire itself would be about the same per circuit foot as the present code wire, and much less than the cost of concealed work or moulding. To the extent that the present fittings are used their cost will be the same, or possibly a shade more, on account of certain very cheap cross-overs or connectors to be used for making joints, but the new system holds possibilities in the way of improved design. It is possible that later the new wire will be installed in conduit with a slight reduction in the amount of labor and increase in safety. The new wire can be used only on grounded systems, and any old-fashioned central station or isolated plant that has not one side or the neutral grounded cannot use it. However, since any such plant, if of less than 150 volts, is breaking the insurance rules anyway, this is not a serious handicap to the spread of the new wire.

The new wire will be used largely for exposed work, running the inconspicuous wires along the surface of the walls, in the corners next to picture moulding, etc., but ultimately it is likely to be used for concealed work. One method used abroad is to cut a narrow channel in the plaster for the wire and then to paper over it, and while there might be a possibility of corrosion, no reports of this have as yet been received. The new wire will involve distinctly more care in installation than the present methods and will therefore be confined to comparatively expert workmen who will possibly command higher wages per day than men who can use only the present methods, although they will work so much faster that the cost per outlet should be less. There is no question that the janitor, chauffeur and schoolboy who now feel warranted in twisting two wires together to form a joint will find themselves "stumped" by the new wire until they have received some instructions. One reason why more expert workmen will be needed is that great care must be given to the polarity so that the wire that carries potential shall not be exposed in any case. The result will be that it will be almost impossible to get even a 110-volt shock and almost impossible to get any connection on the potential-carrying wire except a dead short-circuit that will blow the fuse at once.

Various Types of Concentric Wire

There are at least three types of concentric, bare wire. All have a copper core which may be solid or stranded, then insulation, which usually has some rubber and may have braid and also paper or cambric. The return wire may be a water-tight tube or sheath, or may have a water-tight seam or be braided with fine wires. The smooth water-tight sheath is simplest as regards connections and also is best for moist places or the lighting around oily machinery. For boiler rooms and other hot places the insulation can be of asbestos, and for dry places the non-water-tight construction is probably just as good and cheaper. Almost any American fitting can be used with some arrangement for a cross-over or connection between the outside conductor at joints or connections, which is very simple where soft solder is used. Hard solder requires so much heat that it injures the rubber insulation and is forbidden in the experimental rules. The new construction will do away with the need for insulating joints on gas fixtures, previous to doing away with the need of gas fixtures themselves. While there will always be use for conduit, as regards old houses, wiremen would rather get five jobs at $30 than one at $45, manufacturers would rather make more wire and fittings, and central stations would rather serve every house on a street than merely take the new houses and wait for the older ones to be rebuilt. The new system is by no means for cheap houses only, but should also have a future in good residences.

Status of the Electrical Contractor

Lack of Co-operation of Manufacturer and Dealer with Contractor—Need of An Association with Central Meetings at Regular Intervals—The Right Suggestion—Can't We Put it in Operation?

Editor Electrical News:

In a number of recent issues of the Electrical News, there appear letters on the Status of the Electrical Contractors. Mr. Beattie's letter of December 9th, strikes the spot with regard to would-be contractors whose office consists of a two-cent pencil, a ten-cent note book and a vest pocket. His stock, when he has any,, is generally in the woodshed or under the bed. Now while the majority of these men cut up prices to the extent that they make bare wages and small at that, there are some that do good work and adhere to submitting proper figures, so that the condition of the electrical business to-day cannot be placed on their shoulders. It is rather the circumstances that make it possible for such work to go on that the trade must attack, and by the way, the little contractor in your own town is not the man who goes to your customer and sells him goods at practically jobbers' prices.

Our old friend Mr. Marchand, of Ottawa, gives us the exact truth when he said that if the jobber cannot sell to you he will sell to your customer at your price. Now then, from what we all know and what the letters in the recent issues of the Electrical News contain, every contractor can see that there is more than one and more than two, there are several contemptible circumstances that will have to be remedied before the electrical trade will be on a basis with even the poorest of other businesses.

In the first place we should have the co-operation of the Jobber as well as the Manufacturer. But do we get it? Or do we give our support to the established jobber or manufacturer? Right here are two of the principal points that affect the vital cords of the whole trade. Take a couple of examples: A supply traveller comes into the town and calls on you. He may get a small order this time or he may not. His house tells him to get the business no matter where; he hunts up the fellow with a grip and a brace on the curb and sells him at your price. He then goes to the factories and other industries and quotes them jobbers' prices on their needs. The next week you are called to one of these places to figure on some work; you give the man your price and he laughs at you. Do you know what I can buy that material for, he asks you? So much. And he can get the curb stone man to put it in for so much per hour. And where are you at? The same applies to the fixture man who tries to sell to you and your probable customer at the same time.

Now what woud be the result if every electrical dealer and contractor who maintains an established business in this province were to sit down and not buy or have anything to do with supply houses of this kind. The remedy would be forthcoming and it would only have to be applied once for the good of everybody concerned. To reach this condition we must have an association that will sit tight on any business method with both themselves and their customers and also their supply sources that are not fair. Restraint of trade should not be tolerated. Your customer should get all he

pays for. You also should get a fair profit. And, by the way, don't forget the overhead. Your supply house should be treated with due respect to his profits and investment.

Having outlined a few of the conditions that more or less exist between jobbers and contractors and curb mechanics there remains considerable other work to be done before we can get on the same footing as the grocer or the baker or any other line of business. The strife that exists between local contractors in each town or city must be overcome. Prices must be uniform, there must not be two prices for two different customers. As the legitimate reduction or rise in the price of material goes, the consumer should get the benefit, but the slashing of prices to your competitor's customer and the boosting of them to your own is poor business and there is lots of it. Revenge is sweet, as some say, but the cost doesn't end with a particular transaction. Co-operation has got to come and the sooner the better. Licensing contractors is only a step. Licensing workmen is only another step.

To start this condition of affairs along the road to what I think should be a successful goal, I would suggest that all dealers and contractors in Ontario get together, meet at, say, intervals of three months in central points, such as London, Toronto, Kingston, Ottawa, Montreal, etc., and discuss their whole situation and act on those discussions. It is easy for those in Western Ontario to meet at London and also for those around Toronto to meet at Toronto and so on. Concrete ideas could then be put before the association to act upon.

Yours truly,

The MacKenzie Electric Co.,

(Signed) G. E. Phillips.

Sarnia, Ont.

Repeat Orders Speak for Themselves

An order has just been placed by the Montreal Water and Power Company with Boving & Company of Canada, for the supply of a 6,000,000-gallon pump. This is understood to be the fourth high pressure pump of this design which the Montreal Company has purchased. The three pumps previously supplied are each direct connected to a 1,300 h.p. motor and operate against 200 lbs. pressure, discharging 12,000,000 gals. per 24 hours. These pumps were originally guaranteed by Boving & Company against pitting for a period of one year of 24-hour service, and when opened up recently for inspection, the impellers and guide wheels were found to be in perfect condition and to have fulfilled the guarantee in every respect.

All Night Lighting of Public Buildings

The Ottawa City Council have recently taken up the matter of all-night lighting of public buildings used for residence purposes and a by-law just passed provides that the stairs, halls and corridors of all apartment houses, hotels and lodging houses must be lighted up from sunset to sunrise. One month is allowed owners to comply with the order. The exact reading of the by-law follows:

In all apartment houses, hotels and common lodging houses now or hereafter constructed, all stairs, halls and corridors above the ground floor thereof shall be provided with sufficient means for lighting the same adequately by electric lights, gas or other approved method, properly placed and supported; and all such lights and apparatus shall be installed, connected and supported in such a manner that they shall be fed independently of the wires or pipes serving the other rooms or compartments in such building and shall in every case be furnished with a suitable cut-off switch conveniently placed at or near the ground entrance to such building, and all such appliances and work shall be subject to the inspection and approval of the Electric Wiring Inspector of the Corporation. All such lights shall, so long as such building or any portion thereof is leased or occupied, be lit by the owner, caretaker or other person in charge thereof every day at sundown, and shall not be extinguished before sunrise of the following day. The owner, lessee or agent of every such building, the stairs, halls or corridors of which are not at the date of passing of this sub-section equipped in accordance therewith, shall within one month thereafter comply with the provisions thereof.

Montreal Street Lighting

Competition for installing the new Montreal civic lighting on St. Catherine Street, from Atwater Avenue to Papineau Avenue, and on Bleury Street, from Pine Avenue to Craig Street, is likely to be very keen. The approximate cost is $40,000. The scheme, prepared by Mr. Arthur Parent, lighting superintendent, provides for 6.6 luminous arc lamps of the inverted type, on ornamental standards of special design, spaced 125 feet apart, and staggered. On St. Catherine Street, 43 lamps will be substituted for the present 57 arc lamps, and on Bleury Street 41 in place of the existing 18. The lamps will be fed from underground cables, carrying 7,500 volts, provision having been made for the laying of the cables in connection with the conduit system. The standards will be 14 ft. 6 in. high up to the arc and 12 ft. 3¾ in. up to the main insulator. The circuits are so arranged that in case of an interruption on one side of the street the lamps on the other side will be unaffected.

A U. S. Electrical Jobbers' Convention

The Electrical Supply Jobbers' Association, a United States organization, holds quarterly conventions, the last of which met in Chicago on March 17th, 18th and 19th. This association is maintained with the idea of establishing a better standard of practice in business, not only as regards the relations among the various jobbing houses themselves, but also the inter-relations of the manufacturer, jobber, contractor and ultimate consumer. Only one Canadian company is a member of this association.

New Books

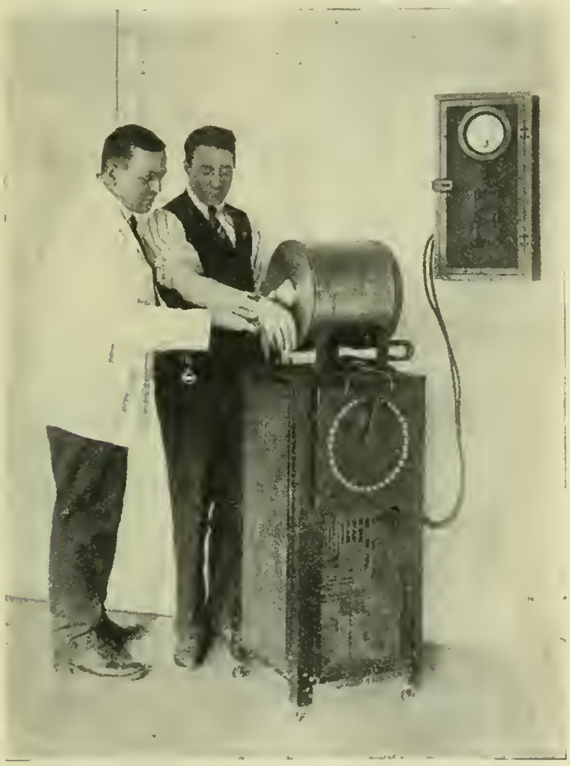
Constant Voltage Transmission—By H. B. Dwight, B.Sc., Mem. A.I.E.E., etc.; John Wiley & Sons, Inc., New York, publishers; price $1.25 net. A discussion of the use of synchronous motors for eliminating variation in voltage in electric power systems. The advantage of constant-voltage transmission, in improved operation and lower cost, have been recently proved by actual examples, among them that of the longest transmission line yet built. The practical success of the method justifies the statement that the use of synchronous motors has been far too limited in the past. It is the purpose of this book to urge that more synchronous motors be installed in alternating-current power systems, and that dependence be placed on them to secure the desirable results of controlling the voltage of lines at the opposite end to that of usual practice, and of more than doubling the power load of most lines. In this way, the installation of comparatively inexpensive machines can take the place of building entire duplicate transmission lines. The decision regarding such important changes in design and operation, even when the examples described are kept in view, must be made according to thorough predeterminations of cost and operating characteristics. Working formulae, with examples, are given for these comparatively new calculations. Although the writer is in favor of the increasing use of the principles of constant-voltage transmission, both in long-distance work and local distribution, he has tried to show impartially both sides of the case, and to outline the conditions where the new method is not applicable.

What is New in Electrical Equipment

Using Powerful Magnet to Extract Particles

It is interesting to note that the Westinghouse Electric & Manufacturing Company have installed in their Relief Department at their East Pittsburgh works a magnet for removing metal embedded in the flesh, which is one of the most powerful in the world. The magnet is mounted on a box containing the resister which is used to regulate the amount of current flowing through the coils. It requires 4,000 watts for its operation, or enough power to supply 100 32-candle-power mazda lamps. It is designed for operation on 70 volts, and as the circuit from which it draws current is used for testing purposes in the works and ranges from 70 to 120 volts, a resister is necessary.

It is not an infrequent occurrence for steel and iron workers to get bits of metal in their eyes or hands. Previous to the installation of a magnet the only means of removal was by probing, a method which is as uncertain as it is painful. Since this machine was put in operation it is a very simple proceeding to extract such particles. The portion of the body in which the foreign particle is embedded is placed near the pole tip of the magnet, the switch closed, and the magnet does the rest. The pole is removable, a number of different shapes being supplied for various classes of work.



Extracting metal particles from the hand.

It is very common for flying bits of metal to lodge in the eye. Should they strike with force enough to become embedded, the removal, without the aid of a powerful magnet, is apt to be difficult as well as dangerous. The protecting coating of the eye must be cut, and there is danger that instead of removing the particle, it may be pushed further into the eye. When the foreign body is once within the eyeball it is properly a case for the specialist.

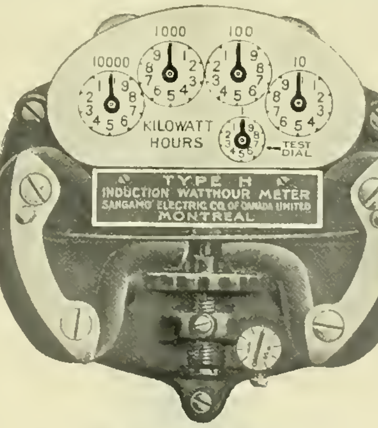
Again, steel workers frequently have their hands punctured with minute pieces of metal, which become embedded under the calloused skin. If these bits are allowed to remain, the wound is likely to become infected. The use of a powerful magnet insures the removal of all traces of iron from wounds in the hand, or any other part of the body. Some remarkably small pieces have been extracted in this city, one recently recovered being not a twelfth of the thickness of a delicate needle.

Dr. C. A. Lauffer, Medical Director of the Westinghouse Company, relates a number of instances in which the magnet has proved invaluable. Among these is the rather amusing case of a workman who attempted to drill one of his own teeth. The drill broke off about half an inch from the end and remained in the cavity, and it seemed as if the only way to remove the drill would be to pull the tooth. However, a special extension was made and fitted to the magnet pole. As soon as the extension was brought in contact with the drill and the current switched on, the drill was immediately drawn out.

New Induction Watthour Meter

With a view to providing economy and convenience to users of their type H watthour meters, the Sangamo Electric Company of Canada, have just placed on the market their new model Type H induction watthour meter. This meter is a decided improvement, both mechanically and electrically, over the old model and claims to include several features not found on other meters at the present time.

In the new model Type H meter, the entire motor magnet system is mounted on the base, which is accurately machined and each part dowelled in position so that the system as a whole is kept in perfect co-ordination and any part of it may be removed or replaced, in case of accident or repairs. Another feature is that the lower fastening screws are under seal at all time preventing shifting of meter to angular position. The terminal box is a separate chamber and the terminals themselves are embedded in fire-proof composition insulation, which effectively seals the entrance of the terminals into the meter proper, making them dust and water-proof. The grid carrying the moving system and permanent magnet may be quickly removed without disturbing any electrical connections or mechanical adjustments, and by its removal



Type H Sangamo Watthour meter.

the motor magnet system is exposed for inspection and accessible for repair.

The new meter also includes a light load micrometer adjustment, which is an entirely new feature. It is positive and susceptible of extremely accurate and fine adjustment. One complete turn of the main screw corresponds to 2½ per cent. at 1/10 of full load. The full load adjustment is positive

and the clamping screw is easily accessible. Among the highly desirable electrical characteristics incorporated in the new model meter, is the improved accuracy under voltage, frequency, power factor and load conditions. The new meter is guaranteed to have a frequency error less than 1 per cent. when 60-cycle meters are operated at 50 cycles. The load accuracy under normal voltage and frequency and at unity power factor, is between plus and minus 1 per cent. for all loads, from 5 per cent. to 125 per cent. of full load. The voltage error is only plus or minus .15 over a range of 10 per cent. above and 10 per cent. below normal voltage. Power

Exterior view type H meter

factor 50 per cent. lagging or leading will not cause an error greater than plus or minus 1 per cent. in polyphase meters, when shipped from the factory and any meter may be adjusted to absolute accuracy. The low losses in the new meter is another feature; the shunt loss at 110 volts, 60 cycle, is only 1.1 watts; the shunt current is only .034 amperes; the series loss is only .33 watts in a 5-ampere meter. Friction and consequent wear have been reduced to a minimum by careful design of all moving parts. The moving system, that is carried by the jewel bearings, weighs only 15 grams, while the full load torque is 48 millimetergrams.

All adjustments are easily made when the meter is in place and the rigidity and accuracy of the construction assures a positively and definitely permanent alignment of all the parts.

The Northern Electric Company have been appointed distributors for the Sangamo Electric Company of Canada, Limited.

Plug for Signal Lamps

The attachment plug shown herewith has been designed by Harvey Hubbell, Inc., Bridgeport, Conn., for use with

Hubbell "Signal" Plug.

signal lamps. The device as shown is connected to a 115-volt candelabra base lamp, protected by a tin-plated lamp guard. The plug is designed for use with electrically heated devices of 10 amp. ratings or less. They are equipped with knife-blade contacts and are interchangeable with various types of attachment plugs for wall and flush receptacles of corresponding rating and style made by this company. The base of the device is of heat-proof composition. This equipment is distributed in Canada by R. E. T. Pringle.

Trumbull Sign Receptacles

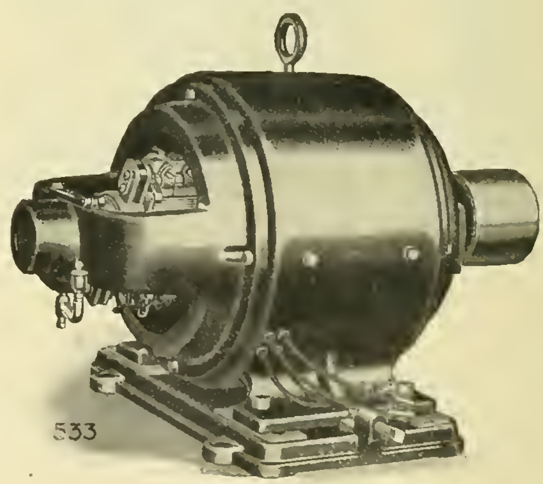
The Trumbull Electric Manufacturing Company have just placed on the market two types of new sign receptacles—the clamp and the two-screw type. The two-screw type is very similar to the usual screw receptacle on the market. The clamp type, however, is more of an innovation. The following are special points about these receptacles,—no screw holes are necessary and the wireman saves time in mounting them; they are installed from the rear, and the wireman does not have to reach the front at all; before tightening the screws, the receptacles can be turned in any direction to line up with

Two new types of receptacles.

the wires; when the screws are tightened, it is impossible to turn the receptacle in the sign; these clamps will take any thickness of sheet iron. The manufacturers specially emphasize the point that the clamp type receptacle is installed entirely from the rear of the board, whereas the screw type generally requires a man on the back to hold the base, while a second man on the front screws the top into the base.

New Direct Current Motor

The new type "C" direct current motor just announced by the Robbins & Myers Company, Springfield, Ohio, and illustrated herewith, is at present made in sizes from 1/8 to 3 horse-power inclusive. The frame is cast iron, and of low,



In sizes 1/8 to 3 h.p.

squatty shape, adapting the motor for installation where space is restricted. The bearing bracket on the commutator end extends well out from the frame and gives easy access to the commutator and brushes. The bearings are oil-ring lubricated and the oil reservoirs are equipped with over-flow and drain plugs.

The motors can be furnished open or fully enclosed, horizontal or vertical constructional for continuous or intermittent service; constant or variable speed; shunt,series or compound wound. They are made for 115, 230 and 550 volt

circuits, also for service on low voltage storage battery circuits. Each motor is regularly furnished with sliding base, no voltage release starter and cast iron crown pulley. They can also be furnished with idler pulley or back-gear attachments if desired.

An Outdoor Metering Outfit

The outdoor metering outfit illustrated herewith, is a recent addition to outdoor sub-station equipment by the Canadian General Electric Company. Power companies operating high voltage transmission lines have found in many cases that a watthour meter and transformer outfit combined in a unit and adapted for outdoor service can be used to advantage from the standpoint of initial cost and also of maintenance where it is not advisable to build a complete substation. The outfit consists of a tank equipped with weatherproof insulating bushings for primary connections and containing two current and two potential transformers

Combined meter and transformers.

immersed in oil. The secondary terminals are brought out to a separate compartment on the front of the tank in which is installed a standard polyphase watthour meter. This compartment also contain switches for short circuiting to secondaries of the current transformers. These switches allow rotating standards or indicating instruments to be connected in the secondary circuits of the transformers for calibration of the watthour meter without disconnecting the outfit from the primary circuit. The front of this watthour meter compartment is fitted with a door firmly secured by a padlock. The advantage of the combined outfit is that a single unit takes the place of five. With the separate outdoor transformers it is necessary to mount two potential transformers, two current transformers and house the watthour meter. In addition, the combined outfit for three-wire, three-phase saves three high potential insulating bushings.

Electric Gear Shifting for Automobiles

The Cutler-Hammer Manufacturing Company, Milwaukee, advise that their "Vulcan" electric gear shift has already been adopted by some of the best-known automobile manufacturers. This device does away with the lever and permits changing gears by means of push buttons located on the steering wheel. It is claimed that this electric gear shift makes it possible to shift gears at will with almost no physical effort and without taking the eye from the road. It is as easy as pushing the horn button. This greatly simplifies the car control, adds to the safety and increases the pleasure of driving. The great success in the use of electricity in the lighting and cranking of the gas car has paved the way to the further utilization of the electric power plant, with which the modern automobile is equipped, by employing this energy to shift the gears.

New Concentrated-Filament Mazda Lamps

Different lamp companies have now standardized 25, 40 and 60-watt mazda lamps with a concentrated coil filament construction similar to that used in the large gas-filled types. The small lamps, however, are not gas-filled. The new construction is claimed to greatly increase the downward or useful light of the lamps, which makes them particularly desirable for service where natural distribution in the downward direction is required. These lamps are supplied in the usual bulbs, the 25 and 40-watt sizes in the S-19 bulb and the 60-watt lamp in the S-21 bulb for 105 to 125 volts. Their rated life is 600 hours.

Rural Street Lighting

A bill has been introduced in the Legislative Assembly of the province of British Columbia, entitled, "An act respecting rural street lighting," which provides for the formation of rural street lighting districts and the appointing of a board of commissioners to execute the act. The district may be formed on a petition signed by a majority of the propertyholders in any district, not forming a part of any present municipality.

The powers of the commissioners are fairly wide and include the "raising of an annual revenue for the purpose of carrying out the provisions of this act by taxes or rates upon the lands in a district and for regulating the mode of assessing, levying and collecting same." All taxes levied are to constitute a charge on each separate portion of land and in default of payment, land may be sold subject only to provincial taxes and other encumbrances and charges registered against the land at the date of the levy of the lighting tax.

A 35,000 kw. Single Unit

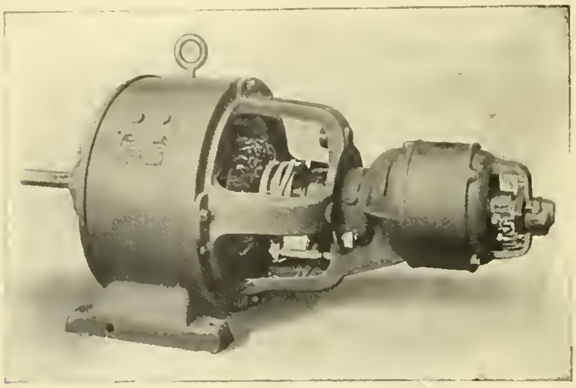
The General Electric Company, of Schenectady, N.Y., are now working on a 35,000 kw. Curtis steam turbo-generator, which is nearing completion. This unit consists of a single generator direct connected to and mounted on the same bedplate with the turbine which drives it. Quite recently this company installed a 30,000 kw. capacity unit of the same general design for the New York Edison Company. This unit to date is the largest of its class in the world, so that the General Electric Company, with their new unit, make themselves doubly sure of holding the large capacity record.

Pioneer Contractor Passes

Mr. Jas. A. Woodman, superintendent of construction of the Hamilton Hydro-electric System, died recently at his Hamilton home. Mr. Woodman was a pioneer in electrical construction work, having, with his brother, H. W. Woodman, erected a number of plants in Canada, including Sherbrooke, Thorold, Niagara Falls, St. Catharines, etc. For a number of years also he had charge of outside construction work for the Cataract Power Company of Hamilton.

Small Belted Alternator

The term "generator" to many minds brings up the vision of huge turbo-alternators, equipped with the most elaborate devices to ensure absolute reliability. Yet there are hundreds of small plants the demand of which does not warrant the use of such huge units but where reliability is just as important. For such service the Westinghouse Electric and Manufacturing Company has perfected a small belted alternating-current generator, with direct-connected exciter. Such an arrangement makes a very compact unit, as well as securing the utmost reliability and independence of operation. This generator has a rated capacity of 20 kv.a. 3-phase or 14 kva., single-phase. The standard frequency is 60 cycles at a speed of 1,800 r.p.m. and the machine can be furnished to give either 120, 240, 480 or 600 volts.



20 kv.a. generator with direct connected exciter.

A bill has been introduced by Mr. Lucas in the Ontario Legislature entitled "An Act to amend the Ontario Telephone Act."

The Metalyte Company, Limited, Winnipeg, Man., dealers in incandescent lamps, have been granted a Dominion charter.

Mr. J. C. Daley, electrical and designing engineer for the Thordarson Electric Manufacturing Company, Chicago, has severed his connection with that company and joined with Mr. J. A. Bennan and Mr. A. R. Johnson in the incorporation of the Jefferson Electric Manufacturing Company. The new company is already located and doing business at 847-851 W. Harrison Street, Chicago, manufacturing a line of toy and bell ringing transformers, ignition apparatus and other electrical specialties.

Trade Publications

Stokers—Bulletin B-2, issued by the Boston Engineering Corporation, of New York, describing and illustrating their type E stoker.

Centrifugal Coal Drier—Bulletin 212, by the Link-Belt Company, of Chicago, illustrating and describing the Wendell centrifugal coal drier.

Voltage Regulation—Folder being distributed by the Canadian General Electric Company, describing their type TA form A-2 automatic voltage regulator.

Automatic Motor Starters—Bulletin B-7, issued by the Allen-Bradley Company, Milwaukee, describing their type Z automatic starters for direct current motors.

Small Motors—No. 22 of this periodic publication, issued by the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., describing their type AR single-phase motor.

Motor Drive in Textile Mills—Bulletin No. 48,016, issued by the Canadian General Electric Company, Limited, illustrating a large number of typical applications of C. G. E motors to textile mill machinery.

"Exide" Batteries—By the Canadian General Electric Company. Handbook describing batteries and parts of the types used with the Delco system of starting, lighting and ignition for gasoline automobiles.

Outlet Boxes and Covers.—Bulletin No. 250 now being distributed by the National Metal Molding Company, Pittsburgh, Pa. This catalogue possesses several novel and distinctive features, such as a line-drawing of each box cover; illustrations on the left-hand margin of the left-hand pages only; boxes of the same type having different sized knockouts numbered to facilitate ordering; short description of the use of each box and cover given in each case; a numerically and alphabetically arranged index giving numbers of outlet boxes and covers of various manufactures and corresponding numbers of "National" boxes and covers with catalogue pages on which the latter may be found.

Personals

Mr. A. W. McIsaac has been appointed city electric wiring inspector in Sydney, N.S.

Mr. H. A. Shambrook, local manager of the C. P. R. Telegraph Company, Toronto, has been transferred to Western Canada with head office in Calgary.

Mr. F. C. Paterson has been appointed commercial superintendent of the B. C. Telephone Company on Vancouver Island, succeeding the late Mr. H. C. Lane.

Mr. Fred Emory, formerly of Nelson, B.C., has been appointed city electrician at Kalso, B.C. Mr. Emory has held various positions with the Westinghouse Company and also with the Northern Ontario Light & Power Company.

Mr. Harry Sherman, wire chief at the Saskatchewan Government telephone plant, Prince Albert, since the inauguration of the new system there, has been transferred to Regina. Mr. C. J. Porter, of Saskatoon, succeeds Mr. Sherman.

Mr. Jas. Kent, manager of the C. P. R. Telegraph System, is retiring after twenty-nine years' service with this company. He is being succeeded by Mr. John McMillan, of Winnipeg, at present general superintendent of the western lines of the C. P. R. Telegraph System.

Mr. Allan Purvis, recently manager in charge of construction and power of the British Columbia Electric Railway Company, has been appointed superintendent of the C. P. R. lines west of Toronto to Windsor. Mr. Purvis was in the employ of the C. P. R. previous to his association with the B. C. E. R. Company.

Mr. W. A. Coates, late chief engineer Ferranti Electrical Company, Limited, has resigned his position with that company and sailed for England to rejoin his old company, the British Westinghouse. We understand Mr. Coates will proceed almost immediately to Russia, where he will have charge of the engineering problems of his company, with special reference to switchboards and switchgear installations.

Leaving out of consideration depreciation and capital charges, the civic car lines of the city of Toronto have slightly more than held their own during the past year. The gross revenue amounted to $166,994 and operating and maintenance to $166,087.

Current News and Notes

Camrose, Alta.

The town of Camrose will purchase during the present year a steam condenser to connect up with a 75 h.p. Belliss and Morcom engine; also an induction regulator for 2,400 volt, 60-cycle current.

Dutton, Ont.

A by-law was recently passed authorizing the expenditure of $10,000 on electrical distributing equipment. The town will be supplied by the Hydro-electric Power Commission of Ontario.

Edmonton, Alta.

On the 5th of March, 1915, the Dominion telegraph was opened at Fort St. John 750 miles northwest of Edmonton. The intention is to extend the line as far north as Hudson's Hope, and it is expected that within a very few days Fort McMurray will be linked up with Edmonton also through telegraph service. The Dominion telegraph line has now 18 offices in the north country in operation and 27 offices east of Edmonton.

The annual report of the telephone department of Edmonton, Alta., municipally-owned, shows a deficit of $38,277 for the year 1914. This brings the total net deficit against the telephone department to $107,573.

Halifax, N.S.

In the local House of Assembly the Secretary of the Board of Commissioners recently appointed to make a study of the water powers of the province, read a report covering the operations to date. It was also announced that the Dominion Water Power Branch had agreed to co-operate with the Provincial Commission to the extent of supplying, without expense for either salary or equipment, a competent engineer to take charge of the investigation work of the province during the summer of 1915.

Kincardine, Ont.

A by-law authorizing the expenditure of $3,500 on extensions to the street lighting system was defeated recently in Kincardine. A lesser expenditure will be undertaken in the shape of new lamps and a small quantity of wire.

Malbaie, Que.

The Nairn Falls Power & Pulp Company, Limited, has been incorporated with capital stock $100,000, and head office in the village of Malbaie, Que. One of the purposes of this company is stated to be the acquiring of the property, franchise, etc., of the Labrador Electric & Pulp Company.

Merrickville, Ont.

The Rideau Power Company has been incorporated with the following officers: Mr. G. F. McKimm, president; Mr. R. W. Watchorn, secretary-treasurer; Mr. A. L. Mills, Mr. T. G. Kyle and Mr. Alex. Mills. The company is at present utilizing one of the Government dams on the Rideau Canal, where a power house for an ultimate capacity of approximately 1,500 h.p. is being built. The first unit is already on the ground and will be installed immediately.

Montreal, Que.

At the annual meeting of the Calgary Power Company, held on March 7 in Montreal, the board was increased from seven to nine members. The entire board of 1913 was re-elected with the addition of Messrs. T. Hood and George Robinson as new members. The board of directors elected is as follows: R. B. Bennett, M.P., president; Sir W. M. Aitken, M.P., V. M. Drury, C. C. Giles, T. Hood, George Robinson, E. R. Wood, A. E. Cross, and H. A. Lovett, K.C.

The Dominion Gasoline Light and Electric Supply Company has registered in Montreal, P.Q.; Joseph Lafantaisie, proprietor.

The Lighting Fixture Company has registered in Montreal, Que.; George Issenman, proprietor.

The City of Three Rivers, P.Q., has renewed the public and private lighting and power franchise for 20 years of the North Shore Power Company.

Mr. James Kent, manager of the Canadian Pacific Railway Company's telegraph system, has resigned after 29 years' service, and is succeeded by Mr. John McMillan, Winnipeg, general superintendent of lines west of Lake Superior. Mr. McMillan has been in the service of the company for 32 years, beginning as an employee in the construction of lines. Mr. William Marshall, of Toronto, succeeds Mr. McMillan, at Winnipeg, with the title of assistant manager, and with jurisdiction over the system between the Great Lakes and the Pacific Ocean. The new superintendent of the Ontario division in succession to Mr. Marshall is Mr. H. J. Lille.

There has been a re-arrangement of the staff of the Bell Telephone Company. Mr. K. J. Dunstan has been appointed Ontario division manager, Toronto; Mr. R. F. Jones, Eastern division manager, Montreal; Mr. F. G. Webber, manager of the Montreal exchange, in succession to Mr. Jones, and Mr. F. Kennedy, assistant manager of the Toronto Exchange.

Newmarket, Ont.

The contract for the supply of wire, transformers and meters has been awarded to the Canadian General Electric Company.

Ottawa, Ont.

The charter of the Niagara & Welland Power Company, originally granted in 1894 and frequently renewed from time to time in the interval, has been cancelled by the Private Bills Committee of the House of Commons.

Port Arthur, Ont.

At a joint meeting of the street railway committees of Port Arthur and Fort William recently, the question of further development of Dog Lake Falls was considered. Commissioner W. P. Cooke is reported to have stated that he considered this development as the best solution of the power question.

Regina, Sask.

The Electric Light, Power & Water Works Departments of the city showed a surplus over the year 1913 amounting to a little over $60,000, but the street railway has a deficit of well over $100,000.

Toronto, Ont.

The Ontario Hydro-electric Commission will ask the local legislature to amend the Hydro-electric Act so as to enable the Commission to take complete charge of the inspection of wiring throughout the province and thus relieve the various municipalities of all responsibility.

Wallaceburg, Ont.

The factory of the Ideal Electric Manufacturing Company has been purchased by Ald. Fred. Brisco, of Chatham, Ont. It is understood that Mr. Brisco will manage the business himself, and that he already has it operating to considerable capacity.

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Generation, Transmission and Application of Electricity

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Hydro-radials Advanced a Stage

The deputation, some two thousand strong, of delegates representing municipalities all over the province of Ontario, which waited on Premier Hearst recently, to express and urge their views regarding Government aid in constructing a system of electric railways covering various areas in the province of Ontario, was sympathetically received. No doubt, when the pressure of demands for money from other and more urgent sources, which all our Governments are just now feeling, shall have been relieved, this matter of Government aid will be dealt with as favorably as the situation warrants. The "hydro-radial" plans of the Ontario Commission are gradually assuming very definite shape, and threaten to rival in magnitude the work of this same body during the past few years in distributing light and power at cost over a very large portion of the province. The early commencement and immediate financial success will depend on contingent factors, however, one of the most important of which is the assistance, which seems justly due, of both the Dominion and Provincial Governments.

It must be recognized that the assurance of success of an electric railway proposition is an entirely different matter from the success of an undertaking to supply light and power. It cannot be overlooked that this fact is borne out by the almost universal experience of those Canadian municipalities which have undertaken to control both their railway and their electric light and power utilities. It is also significant that, so far as published figures show the result, suburban systems operated by private companies have rarely been able to cover expenses of operation during the first half-dozen years and this often, too, when they have been operated in immediate conjunction with large city systems.

The experience of the past in this country at least, therefore, is all against the probability of the Ontario Commission having an easy row to hoe in the first few years of operation of their radials. On this account it is of prime importance that the financial prospects of the venture should be studied in careful detail and very liberal aid given by our Governments to reduce capital and maintenance charges to be carried by the various municipalities. Government aid in this case is surely as justifiable as when, on previous occasions, private corporations have received assistance for a more or less localized railway system, for the reason that the hydro-radial scheme is to cover a very wide area, which may, theoretically at least, be extended to cover the whole province. In any event, the possibility of a branch to any particular area which may now be isolated, will only be possible as a result of the previous construction of what must constitute more or less a trunk railway system, and for this reason, we may all be considered as profiting, though possibly not equally, by the inauguration, in the early future, of such part of this work as seems to promise the greatest assurance of commercial and financial success.

The Government has doubtless taken a wise course, considered from the point of view of the hydro-radial proposition, in cancelling a number of railway charters, which recently came up for renewal and which constituted more or less of a menace to the Government scheme, especially where the plans covered the same or immediately contiguous areas. This action, however, placed on the Government the obligation of having the work of the Commission pushed forward with all possible speed and especially to cover these areas which the cancelled charters were originally designed to serve.

Edmonton Reduces Rates

The Electric Light Department of the city of Edmonton, showed a surplus of $55,000 for the year 1914 in spite of decreased revenue due to the war and consequent drop in business. The report of the superintendent shows that the year 1913 was the "big" year in the history of the department, the gross revenue jumping from $350,000 to $710,000. In 1908 the gross revenue was only $98,000. The year 1914 is the first year in which the revenue has shown a decrease, dropping from $710,000 to $610,000. A comparative statement for 1912-13-14 shows that the net revenue from private lighting, power and street lighting sales were $353,744, $558,-624, and $615,101, respectively. In 1914 the extensions to the system were only about 50 per cent. of that in 1913 owing to curtailment of all expenses. Six hundred and thirty-two poles were set, and approximately 170 miles of wire strung. New business showed a slight increase in the number of light consumers, but a heavy decrease in number of power consumers, the loss in the latter class being 248 horse-power.

Considerable improvement was made in the street lighting during the year. White way lighting system was installed on Jasper, McDougall, College and Whyte Avenue while all alternating current series arc circuits were converted into high efficiency series tungstens, effecting a large saving to the city. A reduction in rates was effective on March 1st, which should be a great inducement for power users. The new rate is as follows:—

For Electric Motors, Cooking and Heating

Rates—
3c. per kw.h. for the first 150 kw.h. (1-150) per month
2.5c. per kw.h. for the next 150 kw.h. (151-300) per month
1.5c. per kw.h. for the next 4,700 kw.h. (301-5,000) per month
1c. per kw.h. for all in excess of 5,000 (5,001 up) per month

Monthly Minimum Charges—
Single phase motors up to 3 h.p.—50c. per h.p. connected
Three phase motors 25 kw.h. per h.p. connected
Heating and Cooking—50c. per kw. connected.

The Growing Use of Outdoor Sub-stations

Their Advantages Now Generally Recognized—Considered Standard Engineering Practice—Great Saving in costs

By Mr. Lester C. Hart*

Some years ago the question of installing high voltage transformers out of doors was taken up by Electrical Engineers of this country. The early pioneers were regarded as visionaries but it has now been shown that they were far-sighted and the results which have since been accomplished have converted their most sceptical opponents. Primarily the cause was an economic one, the desire to serve direct from the high voltage transmission line, the small consumer who could not be reached on account of the excessive first costs of types of installations then in use. To serve them meant either the heavy cost and losses of long secondary lines or the prohibitive initial cost of an indoor Sub-Station.

After an analysis of the possibilities and advantages to be gained by mounting the transformers out of doors, the manufacturing companies developed a complete line of outdoor weather-proof transformers and placed them on the market. The need was at once apparent of suitable switching and protective apparatus. Various types of home-made appliances and make-shifts appeared which have been replaced by a high grade line of horn gap apparatus, particularly designed to meet these requirements.

These early sub-stations were built on wooden poles, and while this method of construction worked out quite satisfactorily it was at the same time open to many objections other than its rather clumsy and unattractive appearance. To meet such requirements as these, the steel structure for outdoor sub-stations was developed. This was the foundation for a phenomenal development.

As the work of the pioneers showed its service ability the applications multiplied rapidly. Transmission engineers in all parts of the country investigated. Items appeared in budgets and load was secured by this means that previously was unattainable.

The outdoor sub-station has now come into its own and is recognized by operating engineers as a standard method of distribution.

In comparing the outdoor with an indoor sub-station there is no longer any question regarding its economical and practical desirability for small capacity stations for all voltages. For the high capacity station the points to be borne in mind are:—

1.—Saving in the initial cost by omitting the building.
2.—Adaptability for enlargement or alteration.
3.—Simplicity.

On a recent installation of a 3,000 kv.a., 66,000 volt step-down station it was conclusively shown that to make it an indoor station would have increased the cost of the station 25 per cent. In another instance a sub-station in the west has been continually added to until it now covers nearly five (5) acres of ground. Think what this would have meant with an indoor sub-station. Other instances showing the practicability and reliability of the outdoor sub-station are the immense Boulevard sub-station at Atlanta on the lines of the Georgia Railway and Power Company, various instal-

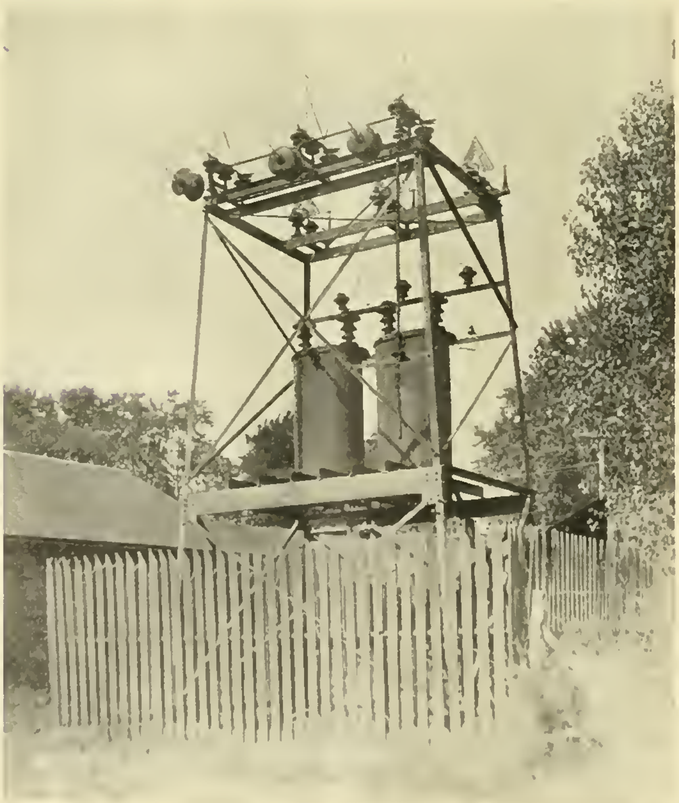


Fig. 1—Typical small capacity outdoor station.

Fig. 2—Sub-station on side of steep hill.

* Sales manager, Railway and Industrial Engineering Company.

lations of the Southern Sierra Power Company and other stations throughout the country. These economies speak for themselves and need no defence.

The outdoor sub-station may be roughly classed according to capacity but there are many other points to be given serious consideration. In various sections conditions differ

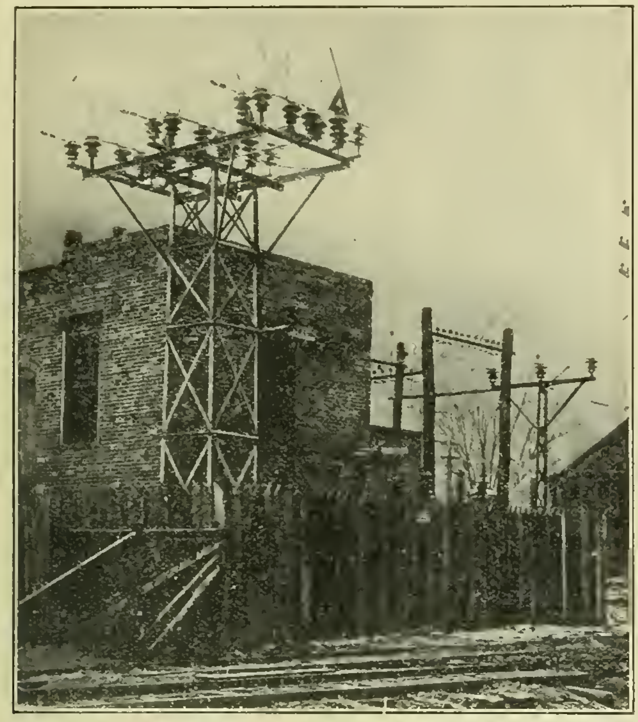


Fig. 3—44,000 volt outdoor station.

widely and require different types of construction due to weather conditions, the type of load served and also on account of the topography of the country. These conditions make it necessary that a careful study be given the design of the station to best adapt it to its load conditions and environment.

In the Central States particularly, the outdoor sub-station finds its greatest field of application in serving small

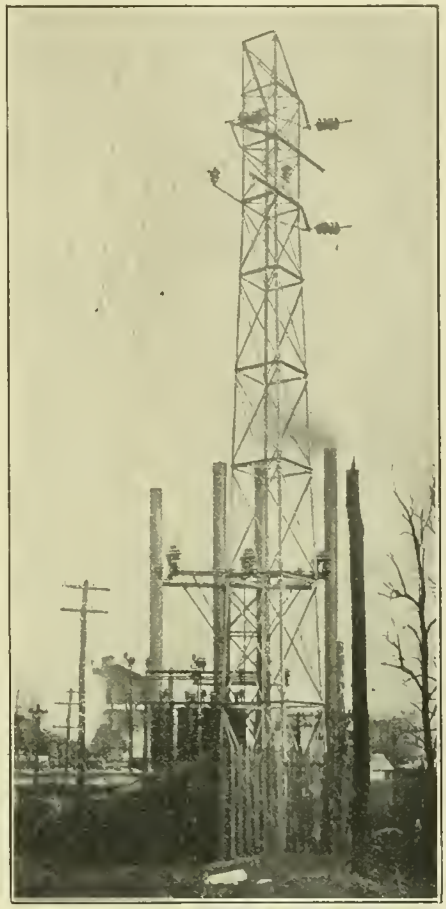


Fig. 4—Outdoor station protected by electrolytic arresters.

communities, farms and dairies, in other sections factories

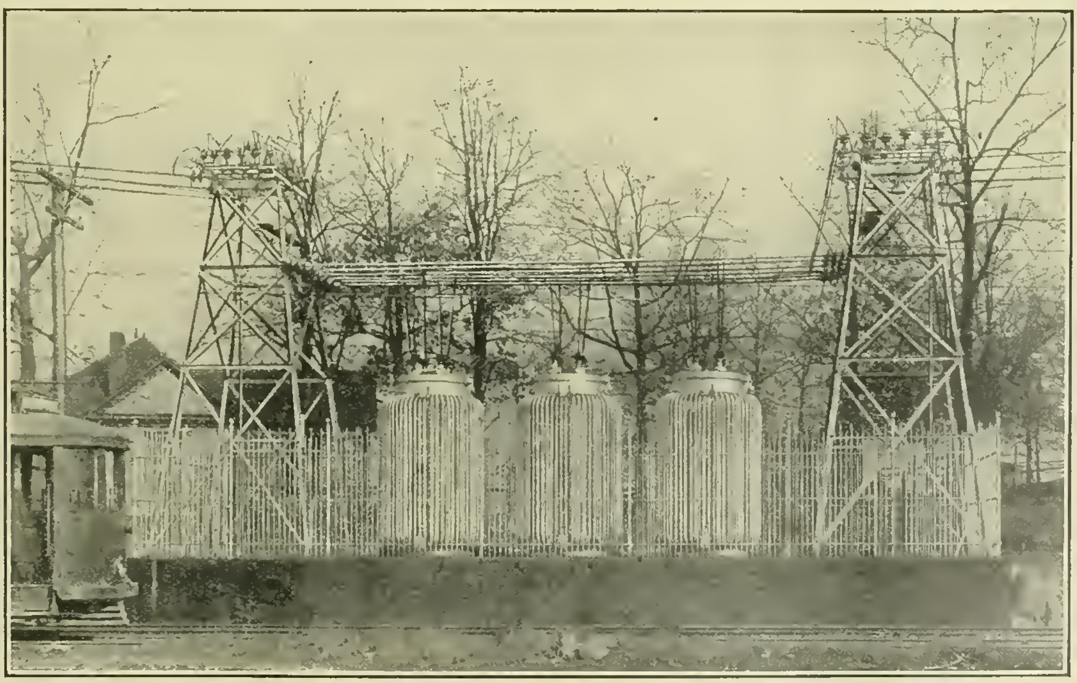


Fig. 5—3,000 kv.a. 11,000 to 22,000 volt outdoor sub-station.

and industrial plants can be served most economically through outdoor sub-stations.

Fig. No. 1 shows a type of sub-station used very generally where the capacity of the transformers does not exceed 300 kv.a. The transformers are carried on a platform some distance above the ground. The station pictured is at Paxton, Ill. The structure will accommodate three (3) transformers considerably larger than those shown in service so that the capacity of the station can easily be increased as additional loads are connected up. Several standard sizes of steel transformer supporting structures, similar to the one shown can now be quickly secured to accommodate transformers from 10 to 300 kv.a. capacity.

The station shown in Fig. No. 2 is used to serve a coal mine load. No space was available for mounting the station, except on the side of a hill. The steel tower is mounted on two (2) concrete piers. Tackle was suspended from the top of the steel structure to hoist each of the transformers into position. No other type of sub-station can be used more advantageously at such a location.

When the capacity of a single transformer exceeds 100 kv.a. it is usually advisable to mount them on a concrete pier at approximately ground level.

Fig. No. 3 shows such a sub-station installed at Covington, Va., on the lines of the Virginia-Western Power Company. The transmission system is operated at 44,000 volts and is approximately 64 miles long. Power is furnished to various municipalities and to a large number of coal mines and paper mills. The C. & O. Railroad is also supplied with considerable power for ventilating tunnels and other purposes. A type of sub-station similar to the one pictured was adopted by them as a standard method of distribution. The transmission line is dead-ended to the steel tower which carries the switching and protective equipment. Bus wiring is carried over the three (3) transformers and is supported by the steel tower and a T. E. lattice steel pole.

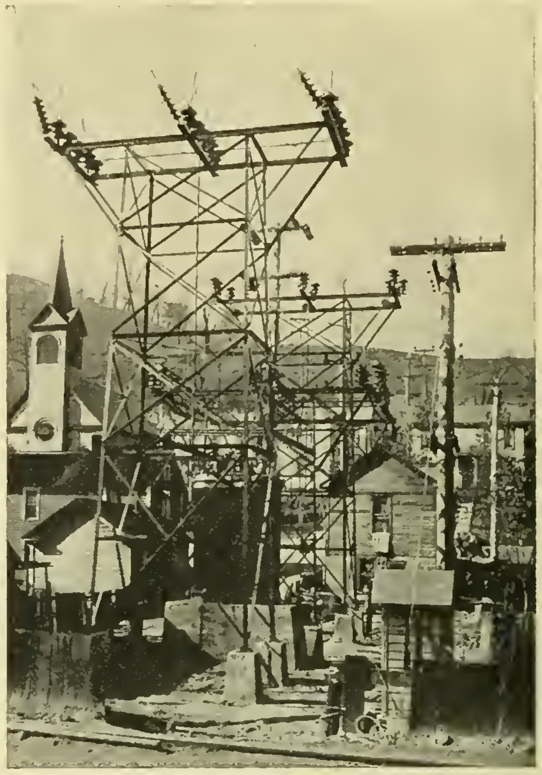


Fig. 6—66,000 volt sub-station.

Another sub-station on this system is pictured in Fig.

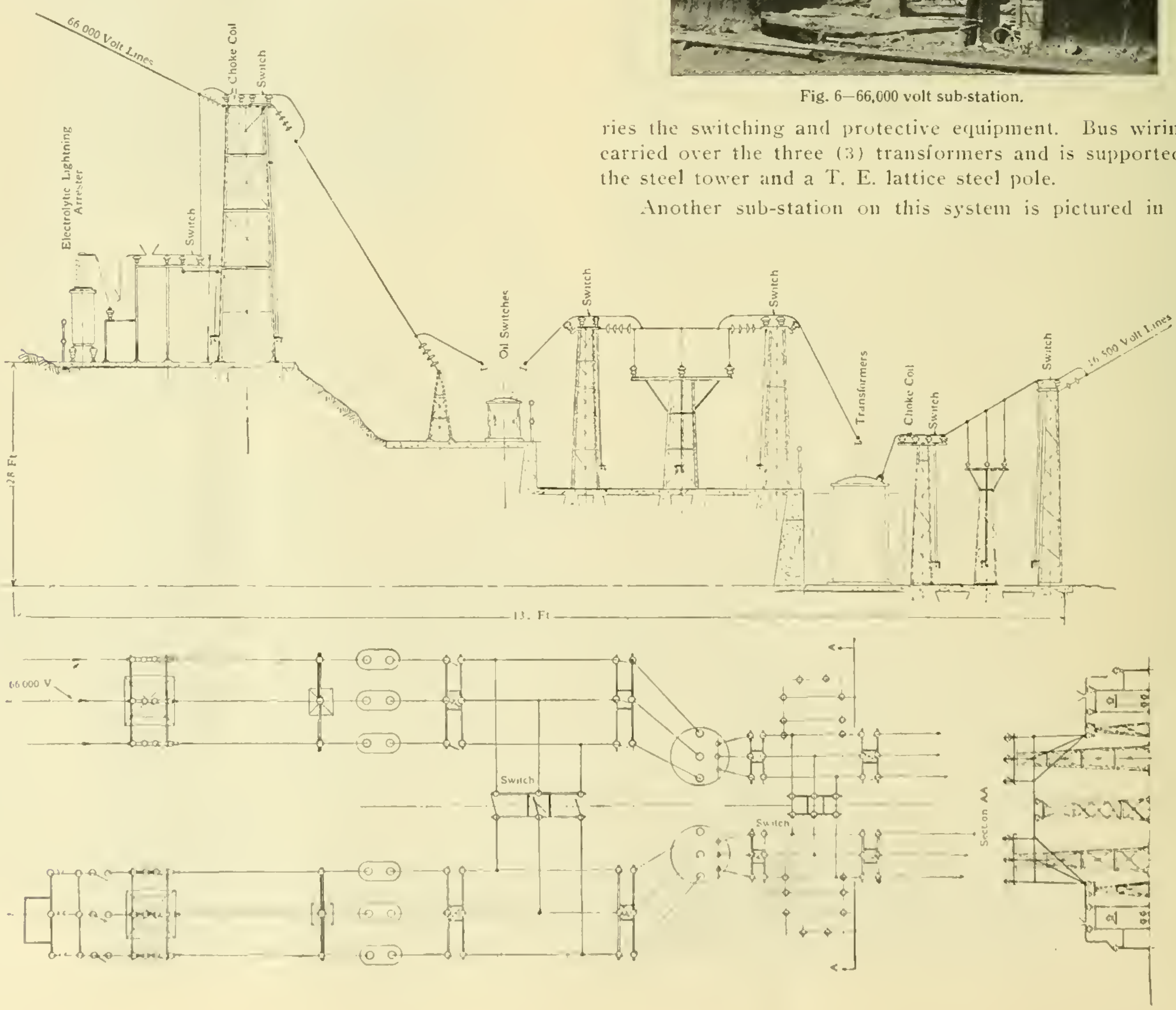


Fig. 7—Diagrammatic layout of a 66,000 volt, 3,000 kv. a., sub-station on a hill side.

No. 4, but is protected with a electrolytic lightning arrester carried on a steel rack which also supports one end of the bus wiring over the transformers. The transmission line is dead-ended on a special steel tower which also carries the Burke Horn Gap Switch.

Near Atlanta, Ga., it was necessary to install a step-up sub-station of 3,000 kv.a. capacity to raise the voltage from 11,000 to 22,000 volts. To meet this need the station shown in Fig. No. 5, was designed and installed at Soldiers' Home Junction, approximately two (2) miles from the nearest operator. It has now been in constant service for over two (2) years.

The sub-station shown in Fig. No. 6, at Dillonvale, Ohio, is connected in the 66,000 volt loop system of the Wheeling

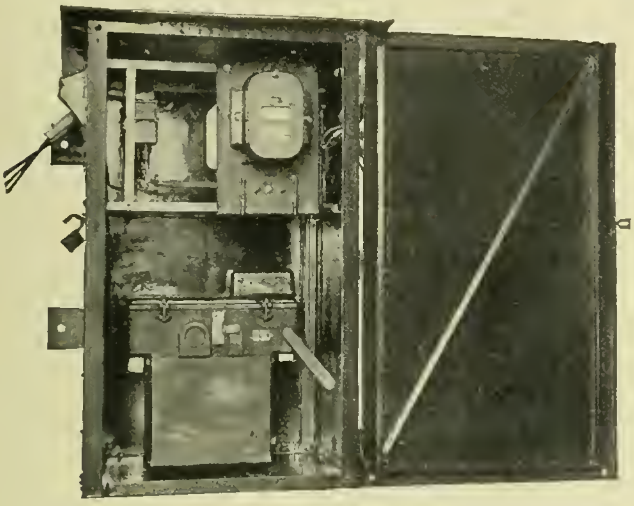


Fig. 8—Weatherproof steel meter house.

Electric Company and serves power for this community. The Horn Gap Switches on the two (2) steel towers serve for sectionalizing the transmission line on either side of the station. The transformer can be seen mounted on a concrete block between these two (2) towers directly below the steel framework which carries the protective equipment.

At Steubenville, Ohio, it was necessary to install a substation consisting of two (2) 1,500 kv.a., 66,000 to 16,500 volt transformers with the necessary protective equipment and switches so arranged that either of the two (2) transformers might be tapped to either of the two (2) incoming 66,000 volt lines. There was only one location available for this station and to make it of the indoor type would not only require a large building to house the equipment but also a great deal of excavation would have been necessary as the station site was on the side of a hill. You will notice that the natural contour of the ground was taken advantage of in the design and also simplicity of the layout. Fig. No. 7.

It is often desirable to install metering equipment on the low voltage side of the outdoor sub-station and also an oil circuit breaker to protect the transformers against normal over load.

Fig. No. 8 shows a weatherproof steel house designed primarily for this use. The arrangement of the apparatus is very compact but at the same time everything is easily accessible through the door. The potential transformers are mounted back of the integrating watthour meter in a position that can be readily reached if desired but where there is no danger of the exposed fuse clips being accidentally touched. The series transformers can be seen at the side of the slate panel on which the meter is mounted. The overload oil circuit breaker is mounted directly on the steel frame work. A slide covers the opening in the bottom of the house through which the oil tank of the circuit breaker may be lowered.

The successful operation of the outdoor transformer station during the past several years shows that the transformers and protective equipment has been successfully developed to meet the severe conditions imposed and indicates its extensive use in the future. Although cost is one of the main factors, the operating features, its simplicity and the fact that the outdoor sub-station makes itself almost a part of the line construction makes it more attractive as transmission voltages increase.

It has demonstrated that good electric service can be supplied at remote locations at an attractive price and the greatest revenue derived. It has demonstrated its reliability at many of the large distribution centres as well as at the remote locations.

The success which has been obtained through the use of the outdoor transformer sub-station on the lines of the transmission companies in all parts of the country justifies prediction that it is the sub-station of the future and will occupy a most important position in the development of transmission work.

Evolution of the National Electrical Code

By F. A. Cambridge, City Electrician, Winnipeg, Man.

Prior to 1897 there were no uniform rules. Insurance and central station interests' rules varied widely. No municipal inspection—in Winnipeg none prior to 1898.

The first edition of the National Code was published in 1897, and comprised 41 pages. The last edition, published in 1913, comprised 176 pages. The next edition is to be issued this year.

The original drafting committee of the code comprised representatives of all the interests concerned, viz.—the central stations, electrical engineers, underwriters, and latterly the contractors and municipal inspectors. Most of the original rules stand to-day practically unchanged—elaborated it is true—but unchanged in fundamental intent, the idea being to disturb as little as possible the existing conditions. Some of the more important rules adopted from time to time are as follows:

1899—Elaboration of iron conduit rules and first mention of armoured cable.

1901—First rules allowing, but not calling for, solid grounding of low potential wiring. The low potential class limits were also changed from a permissible maximum of 300 to 550 volts, due to advent of a.c. power distribution.

1903—Introduced new rules covering extra high potential wiring for outside distribution. There was also a material elaboration of class D rules relating to approved fittings.

1905—Brought in a number of new rules as to heating devices; also new rules relating to new wiring devices such as the flush switch—new rules covering wiring of unfinished attics—mixed knob and tube work—entire revision of rules relating to wiring of street cars. This year also standardized the enclosed fuse and its base.

1907—Saw an elaboration of the rules relating to motor installations—the first set of rules relating to metal moulding. But more important than all over seven pages were devoted to theatre wiring. This was the direct result of the Iroquois Theatre fire December 30th, 1903. What is perhaps a new departure in the Code, is the fact that in these theatre rules appears evidence of the desirability of including rules cover-

ing Safety to Life as well as those merely affecting the fire risk. The use of conduit for theatre wiring was rendered compulsory; also the provision of duplicate supply of current for exit and emergency lighting. The rule requiring a fire-proof booth inclosing moving picture machines and operator also appeared for the first time.

1909—This edition of the code formulated rules for the carrying into buildings of service wires by means of iron conduit. The rules for grounding were also revised but still only written in an advisory sense. The neutral fuse is now allowed to be omitted, provided neutral is grounded if wire is same size as outer wires. Another indication of progress is the suggestion that covered snap switches be used in place of knife switches on lighting circuits. Some new rules also appeared bearing on electric light fixtures particularly as relating to fire-proof building work and also as to a greater degree of care to be taken in insulating wires from gas pipes at outlets—one of the weakest points. New rules also appear governing installation of mercury vapor lamps also vacuum tube system of lighting.

1911—Introduced 3 pages of rules relating to electric signs. Rules governing installation of wireless telegraph apparatus. More important than any the new specification governing the manufacture of rubber covered wire.

1913—Rules cut out use of hardwood for skeleton switchboards in power houses and also added a new rule requiring a non-combustible outer cover on all inflammable wires when bunched together as in rear of switchboards; some important changes were made in wiring of resistance elements of rheostats and a concession is made relating to wiring of a.c. motors in that the safe carrying capacity of Class B wires may be used for figuring rubber covered wires—this, however, is not allowed when circuit breakers with time element devices are used.

The most drastic amendment of all however, is the set of rules making the **grounding of all low potential circuits compulsory.** In this edition is to be noted a number of new rules and changes dealing with the factors concerned with the overloading of branch circuits. Some important though seemingly minor changes are made in rules relating to switches calling for double pole where wiring is in damp places, and as to floor receptacles exposed to mechanical injury requiring specially designed outlet boxes, and as to attachment plugs for heaters, etc.

An elaboration of the rules on conduit and armoured cable is to be noted—one in particular to the effect that outlet boxes, also cabinets, must be so installed that the front edge will not be more than ¼ in. back of this finished surface of the plaster and that if this service is broken or incomplete it shall be made good. Among other amendments may be noted those dealing with moving picture machine operation—outline lighting also a number of rules relating to methods of wiring in general.

As to suggested changes that are coming before the Electrical Committee of the N. F. P. A. at their 20th annual meeting this month, it is premature to speak at present as no doubt many suggestions will be entirely eliminated and others materially changed—I will, however, allude to a few likely, in my opinion, to pass coming as they do from the various sub-committees dealing with various sections—these are not to be confused with "general suggestions" made by outside interested parties:—

Changes Suggested by Sub-Committees—1915

1. To allow fuses in multiple or cables having safe carrying capacity exceeding rated capacities of largest enclosed fuses.

2. Junction boxes in attics provided sufficient head room exists reached only by a portable ladder and permanent hatch.

3. Some importnt rules are suggested governing tests on various types of transformers including those for operating bells and mechanical toys.

4. A rule limiting the number of overhead services to any one building and making compulsory the feeding of a terrace or a row of buildings up to five by one service. Services to be run in conduit. Also a rule calling for multiple service cables for No. 6 wire or smaller.

5. Some very important rules relating to ventilation of moving picture machine booths calling for a cross-section of not less than 78 sq. ins. in the ventilating shaft and which must be led outside of building or to a special fire-proof flue also providing for an exhaust fan in the vent with a capacity of 50 cubic feet per minute. Rules also covering the miniature moving picture machines with fireproof films.

6. Regulations covering gas-filled incandescent lamps—calling for the use of special fixtures—slow-burning or asbestos insulated wire from outlet to sockets and in show windows or other locations where liable to come in contact with inflammable material their use is only allowed when mounted on approved fixtures wherein the temperature of any exposed surface does not exceed 200 deg. Fahr. The use of these lamps has also introduced new rules regarding the ordinary brass sockets—the use of same not being approved for ordinary lamps over 200 watts or for gas-filled lamps of more than 100 watts, the latter form of lamps also requiring mogul base if over 200 watt capacity.

7. Some excellent and necessary rules are also noted dealing with the manner of grounding the conduit system of a building—the enamel or other non-conducting coating must be removed at points of contact—also rust scale, etc., from the ground pipe—ground wires must be protected from mechanical injury—in plain sight or readily accessible, and the ground of a conduit system not to be considered as a ground for a secondary system.

8. A very important set of rules appears for the first time applying to wiring of garages. However, this city, acting in concert with some of the larger U. S. cities has had such rules in force for over a year—thus anticipating the code.

9. An entire revision of rules relating to construction of cabinets is noted introducing improvements in design that are urgently required.

The Committee on Safety to Life make some important recommendations; one calls for closing off back of switchboards by gates or gratings; another deals with height of wires over roofs and a most important rule calls for the enclosing of the main line entrance switch and fuses in a cabinet.

The last committee report deals with what is known as the grounded concentric wiring system. The committee merely reported progress and submitted a set of rules not for inclusion in the Code but merely as a basis for obtaining further expert opinion. You are probably aware that two considerations have led up to the advocacy of this system.

1. A desire (merely on the part of the central station interests) for a system of wiring possessing advantages of low cost, ease of installation and good appearance.

2. A desire to protect persons against injury by the use of a grounded system having no ungrounded exposed current carrying parts.

The construction of the electric street railway at Three Rivers, P.Q., will be started early in the spring, the first part of the system being six miles in length. The Three Rivers Traction Company, a subsidiary of the Shawinigan Company, have the right to carry freight; at the termination of twenty years the franchise may be renewed or the property taken over by the city as a going concern on terms to be agreed upon by arbitration.

The Electric in the Taxicab Field

Specially fitted for city traffic—Costs less to operate—Higher factor of safety to life—Some concrete examples.

By A. Jackson Marshall*

A new field for the electric, and one rich with opportunity, is that of taxicab service, for which the electric vehicle is pre-eminently fitted. Because of the electric's fitness for this, and because of various advantages therefrom, the electric vehicle manufacturers are now enthusiastically pushing along this line of inevitable success.

In considering why this movement is marked for success it is necessary to know taxicab requirements and to see how the electric will fill these; to consider concrete instances of electric taxicab service; to examine the field as a market for cars; and to recognize the value of the opportunity for a wide spread and sustained public demonstration of electric vehicles.

Taxicab service makes two fundamental demands upon an automobile; that it be of low operating cost and that it be especially well adapted to city traffic. Let us see how the electric will answer this purpose.

Operating Cost

That the electric is cheapest to run, has been proved by experiment and by exhaustive analyses of comparative cost records of horse-drawn, gas and electric vehicles. Several reasons for this lowness of operating cost are evident: electric current is cheap; the electric has tire expense reduced to a minimum; and its simplicity of mechanism eliminates heavy repair bills. Since taxicab service is a business based wholly upon running vehicles for profit, this economy is vital—for the operating cost is more important here than in running a private pleasure car as a luxury, or in operating commercial delivery wagons as a means to an end. Therefore, insofar as economical running cost is concerned, the electric is qualified to lead as a taxi.

Fitness For City Traffic

The fitness of the electric for city traffic is pointedly expressed in a story told of a gentleman and his wife, both of whom have their own cars, who had occasion to use a taxi through some very congested streets. They became aware of an unusual smoothness of motion; the stops in traffic delays were without jar; the starts were quick and smooth, the uninterrupted going, swift and easy. Was it the chauffeur? Perhaps. Some chauffeurs are more expert than others in manipulating the rather complicated mechanism of the average taxi. The man, thinking he had located a good chauffeur for private service, hinted, in paying the bill, at possible employment, also inquiring the make of car. To his amazement, the deft chauffeur informed him that it was an electric.

"Well, if I'd known that," remarked the "fare," "you'd never have had me for a passenger. I always imagined the electric was a slow-coach for nervous old women. You have not only given us the most satisfactory ride we have ever had, but you have unintentionally sold me an electric."

Indeed, the greatest ease of travel is characteristic of these cars. There is no jerk at starting, no lurch and jolt at abrupt halts. Quickly and quietly, the electric starts as silently as it stops, getting under way before other cars have "picked up." There is an absence of jars and vibration that makes it exceptionally restful. There is none of the noise of the old type taxi, no smell of gasoline, no dirt or grease—the electric is noted for its cleanness, and a clean public cab is meritorious.

*Secretary, Electric Vehicle Association.

"Safety First"

Furthermore, the speed is not whatever the temper of a reckless chauffeur makes it. Many people dread the rash haste of careless chauffeurs. The speed of the electric is enough and not too much for city traffic—25 miles an hour at the most, and the ease of control reduces the possibility of accident to a minimum. A careless driver cannot put on too high a rate dangerous in sudden spurts through crowded streets and crossings. For these reasons the electric practically eliminates accidents and payment of damage claims—acting both as a good business asset and as a guarantee of safety to passengers. Thus it is true that the electric is a really important "Safety First" factor.

Its characteristics make the electric essentially the car for town use, and as taxi service is essentially a town service, this is an excellent example of fitting the right peg into the right hole.

Concrete Instances

The most extensive application of electrics to taxicab service at present occurs in Berlin, where there are about 600 electric taxis, 1,600 gasoline, and 2,500 horse cabs. The Berlin municipal authorities have passed an ordinance limiting the number of gasoline driven cabs in order to prevent introduction into circulation of a number of gas cars in excess of public necessity. A letter dated July 28, 1914, from the Director of Police, Berlin, to the Electric Vehicle Association of America, relative to this taxicab ordinance, says, "This will eventually help the introduction of electric cabs in this city."

According to a paper by Mr. E. W. Lloyd, of the Commonwealth Edison Company, Chicago, and Vice-President of the National Electric Light Association, this progressive electric vehicle development in Berlin is due largely to the fact that the Berlin Central Station Company and the Battery Company, have realized the importance of this opportunity, and have devoted their energies to promoting the electric taxicab service there.

What is probably the best example of this development in the United States is that of the Detroit Taxicab & Transfer Company, which is, by the way, one of the oldest gasoline taxicab companies in America, and their use of electrics has only come about after thorough tests of all taxi types. Some time ago this company became convinced that the old style cab had grave faults, and began a campaign for "Better Taxis." An interesting account of this campaign appears in the issue of the "Detroit Saturday Night" for January 16, 1915, the substance of which is given here.

After much experimentation, a model was finally evolved, and in order not to raise expectations which might be disappointed, this car was put to severe tests without any mention of it being made. For three months it was tried out on runs from Detroit to Ann Arbor and other nearby cities, and was driven around Grosse Isle over rural roads, and given other endurance tests. To the surprise of the officials, it came through these better than they had expected. Then, without any announcement whatever, it was put into service on June 25th last at the Hotel Ponchartraine, on a 12-hour-a-day schedule, and left to work out its own salvation. It was not long before the public began to be heard from. More and more people who made their taxi engagements in advance, asked for the use of this particular cab. Old patrons of the company who had not shown any desire to be particu-

lar before, began to be annoyed if they could not get the electric when they wanted it. In one month, September, this car had a mileage of 1,375. In one day it made 8 trips from the Indian Village to Grosse Pointe and came back smoothly under its own power. By the time the new electric had run 12,000 miles, including its road tests and actual service, it had proved itself without any doubt whatever. The public wanted it and it had the best record in every way of the seventy odd taxis operated by this company. In all this time this car had not had nor needed any repairs, and had never had any kind of an accident. It had gone through mud and high snow banks, and over the roughest kind of pavement, and had never given the least trouble in any way. Ten more electric taxis, similar to the first in design but with some slight refinements in contour, are now being put into service, taking the place of ten gasoline cars. As fast as they can be manufactured, other electric cars will be put on the runs, and by the end of this year it is reported that the Detroit Taxicab & Transfer Company will have practically all electric equipment, making a fleet of over 70 electric taxicabs.

The particular model which is used by this company is interesting even to the layman. Its chassis is simple of line and with strength to beat the weight of truck body. The body is of ash and aluminium, and the roof is of one piece so that it cannot leak. Windows at the front and back and in the doors, are easily lowered to provide ventilation in warm weather. The upholstery is of simple elegance. Gray whipcord is the material, and the cushions are broad and soft. The rear seat accommodates 3 persons, while 2 other seats are provided which can be folded up out of sight when not in use. The bodies are richly colored in deep blue with the company's monogram on each door.

There is little to get out of order in the simple mechanism of such a car, so that the wear and tear of careless driving cannot work the havoc on the electric that it does on the intricate mechanism of the ordinary taxi.

Each of the cars used by the Detroit Transfer Company is said to have a capacity of a hundred miles on a single charge, but to obviate difficulty a number of charging stations have been established, while at each cab-stand a charging apparatus is installed, so that when a driver comes in from a run, he puts his charging connection in and restores the batteries while waiting for another call. By this "boosting" system an unlimited mileage is assured. The charging of these batteries is a simpler operation than filling a gasoline tank, for it is hardly more complicated than "turning on" an electric lamp.

It is significant that the electric taxi has won this recognition in Detroit, the home of the gas car, and probably the largest gasoline automobile centre in the United States, both in the number of manufacturers and in the percentage of users. That the electric should achieve this success on the gas car's home ground, argues well for its merit and gives more real weight to the circumstance that if it had occurred in a city of inconsequential standing in the automobile world.

Besides this success in Detroit, there are similar instances in other leading cities, many of which have already progressed beyond the experimental stage.

Outlet For Manufacturers

It can be seen, therefore, that there are good reasons for believing that a taxicab service promises a large new outlet for the manufacturers of electric vehicles. The new taxi will attract the patronage of many people who have not been in the habit of using public vehicles. Women, especially, will enjoy their smartness, their comfort, safety, and cleanness. They have the appearance of the best private motor cars. For shopping, for paying calls, for going to and from the theatre and dances, the electric taxicab is the smartest and best means of conveyance. There is no odor of gasoline, nor any grease to threaten the finest gowns. The electrics are distinctive in their superiority over the older types, and will greatly increase the field for hired cars and the development of the electric vehicle industry.

Demonstration Value

A most important aspect of this development is the rare opportunity it affords for actual demonstration of electric vehicles before the public. One of the reasons why gas cars are so often bought when, as a matter of fact, an electric may serve the purpose better, is because people see more gas cars and know more about them. Extensive taxi service will keep electrics continually and directly before the public eye and get attention in a forceful way not afforded by mere publicity tactics. The influence absorbed unconsciously by the public from having efficient electric vehicle operation constantly before it, will, by sheer force of repetition if in no other way, break through into conscious recognition of the electric's worth. No form of advertising could be more effective than a wide-spread and sustained operation of actual cars before the very faces of the populace. This is potent publicity before which a mere pamphlet campaign looks weak indeed.

Read Before the C. S. C. E.

The March 15th issue of the Electrical News contained an article on "Street Railway Track Construction," by Mr. H. J. Tippett. We omitted to mention that this article was read before the Vancouver branch of the Canadian Society of Civil Engineers.

Personals

Mr. J. P. Verner, superintendent of the Brantford Municipal Railway System since it was taken over by the municipality, has resigned. Mr. Verner was previously manager of the company that formerly controlled this system.

Mr. G. A. Phillips has been appointed Montreal manager of the C. P. R. telegraph department, having been transferred from Calgary, where he was manager from 1912. He was previously assistant manager in Toronto.

Mr. L. A. Campbell, Rossland, B.C., Manager West Kootenay Power and Light Company. Mr. Campbell is also member for Rossland Constituency in the Legislative Assembly of British Columbia.

The Dealer and Contractor

First Meeting of the Master Electrical Contractors' Association of Winnipeg a Big Success—Addresses Full of "Meat"—An Organization of Tremendous Value to the Trade

The First Annual Meeting of the Master Electrical Contractors' Association of Winnipeg, Manitoba, which was in effect a Convention, was held in the St. Regis Hotel, Winnipeg, on Thursday, March 25th. A mid-day luncheon was followed by a business meeting and an excellent paper and discussion programme.

This association was formed just a year ago and already has made very real headway towards its avowed mission of improving the conditions surrounding the electrical contracting business in that city. To use the President's words, "We seek to remove prejudice and then to deserve support." It is gratifying to note that progress has been made towards "Licensing." We look on this as one of the most urgent necessities in the electrical contracting field to-day.

One cannot but be struck with the fact that though there are over 100 electrical contracting firms registered in Winnipeg only 15 of these are members of this association. This recalls to us the remark of a contractor in another large Canadian city, where a similar association exists, that only some 20 out of four or five hundred contractors have allied themselves with the association. It may not follow that because a contractor does not join the association he is an undesirable or inefficent member of the trade but it is more than a coincidence surely that the best known names for both quality of work, quantity and integrity are to be found on the list of those who have allied themselves with the association in their cities. In any case, we contend that the contractor who fails to join his local organization is a poor sport in that he is willing enough to profit—and must profit in spite of himself—by the improved conditions brought about by such associations, though he will give neither his time, money, nor moral support to the improvement of those conditions. If the size of the fee is an obstacle this should be adjusted, temporarily anyway, for members mean strength in the sense at least that a minority always has greater difficulties in accomplishing its purpose. Those who make our laws are apt to believe that any who are not allied on the side of a proposition that is being presented are necessarily against it, and this is especially the case in a technical matter like the one under discussion where our councils and legislators are of necessity not well informed.

The first annual meeting of the Winnipeg Contractors' Association was evidently a very encouraging success, due in great measure to the energetic co-operation of its members with the aggressive officers of the association. Following are the officers: R. L. Riggs, president; B. D. Taylor, 1st vice-president; C. Marriott, 2nd vice-president; J. R. C. May, secretary; N. A. Rippengal, treasurer; and the organization comprises the following members: Schumacher-Gray Electric Company, Limited; Star Electric Company; Winnipeg Engineering Company, Limited; Union Electric Company; Trott & Griffin Company; W. J. Whittaker Electric Company; Linton-May-Lush Electric Company, Limited; Elmwood Electric Company; Gordon Electric Company; Manitoba Electric Company; Marriott-Denbigh Electrical Company; Scorer Bros.; Levvy Electrical Company, Limited; C. W. Cowan; C. C. O'Neill & Company.

The papers' programme was unusually good covering topics of vital importance to every electrical contractor. Mr. J. H. Schumacher discussed "Efficiency in the Electrical Contracting Business." Other papers were "Competition and the Electrical Contractor" by S. A. Barber, of the Union Electric Company; "The Jobber in the Field" by H. W. Billing, of the Northern Electric & Manufacturing Company; "The Contractor in the Field" by C. Marriott; "Credits" by C. T. Kummen, of the Schumacher-Gray Electric Company, and "Evolution of the National Electric Code" by F. A. Cambridge, city electrician of Winnipeg. In addition the president and secretary both delivered inspiring addresses, which we are pleased to be able to reproduce below. As far as our space will allow, we are also reproducing the papers presented. Though of special interest to the City of Winnipeg they will be found scarcely less applicable to electrical contractors all over the Dominion. The Association welcomed at this meeting also Mr. J. W. Marsh, President of the Standard Underground Cable Company, of Pittsburgh, and of The Standard Underground Cable Company of Canada, Hamilton, who briefly addressed the contractors on matters of mutual interest.

President Riggs' Address

Gentlemen,—It is with much pleasure that I welcome you in behalf of the Master Electrical Contractors' Association of Winnipeg. At this, our first annual meeting it seems most appropriate that we should have the privilege of acquainting you with the meaning and result of our organization. I know we shall all part feeling benefited by the opportunity this gathering has offered, of a clearer understanding and closer fellowship, one with the other.

None of our members is disappointed with regard to what he has accomplished during the past year and each feels that it was a wise motive which prompted him to join this newly organized body. We all felt that the electrical business in this city was not on a proper basis. Each contractor was moving in a narrow sphere, and in striving to estimate lower than his competitor would often be willing to take a contract, regardless of profit.

We have found by hard experience that this method of conducting business was conducive neither to progress nor prosperity. To better conditions then, we got together, discussed matters and finally decided to form our present association. And so, we have found by meeting, and knowing him on a friendly basis, that our competitor is not such a bad fellow after all.

Furthermore, we have advanced a step and made the acquaintance of the jobbers and wholesalers and have found

that they too are our friends in this work. And we have met still another man and his staff and have found his support beneficial to us. I refer now to Mr. Cambridge and the city electrical inspection department.

So you see, gentlemen, we have accomplished something by our efforts and I am sure that I voice the sentiments of the association when I say that we shall appreciate your support.

It has been said that there are three kinds of electrical contractors:—the progressive, the semi-progressive, and the

Mr. R. L. Riggs, President.

non-progressive. The progressive contractor is the man we all like to know and the man that our association wants as a member.

The semi-progressive is the "show me" kind and the one who says "You go ahead and if it is all right I'll join in." This man while not desirable would be welcome because I think we might help and improve him.

The non-progressive contractor is a parasite living on the community, taking the vitality out of his fellow workers and unknowingly injuring himself at the same time. One must progress or deteriorate—there is no alternative.

In our city directory there are listed some one hundred electrical contractors, not all of whom, I regret to say, are progressive. We are all inclined to allow ourselves to get into a rut, but we have found that association with our fellow workers broadens our outlook and is to our general and individual advantage and interest. New members will be most welcome as we believe we can help them and I am sure they can help us.

Our association aims to impress upon its own members a full sense of our obligation towards those we serve, and also to drive home to the public a few plain economic truths which must be evident to the average sensible man.

The Master Electrical Contractors' Association has taken the open, intelligent course. It seeks to remove prejudice and then to deserve support. The keynote of its code is responsibility, frankness and fair play. The first obligation is service to the public, and the first essential of service is safety. We stand on unassailable ground when we insist upon the sacredness of contracts and upon honest and fair dealing. In order to demand it of others we require first that we should respect it ourselves. We insist upon the square deal whether it relates to the architect, the jobber, or the general contractor. We recognize the increasing demands for both quality and quantity of electrical equipments, and feel that there should be a fair return for labor and material.

Progress is our watchword, our constant aim and ambition is to make headway and accomplish better things. All too frequently we are inclined to subside and to sink into a state of self satisfied lethargy. Some of our best improvements are accomplished by those whom we do not consider expert. As an illustration:

The growing of corn is a very old art, and in comparison our profession may be said to be very young. When the first ear of corn was grown history does not tell us. Nearly the entire human race at one time or other has had to do with growing this cereal, and the general methods to be followed were matters of common knowledge among farmers. A few years ago the average yield per acre in the State of S. C. was 8 bushels. Last year the average was 18 bushels per acre. This clearly shows growth in intelligence of culture. The cause of this increase was due to the boys of that state. They have in S. C. the Boys' Corn Club and over 5,000 boys are enrolled in this club. The boy who stands out pre-eminent in this contest is Jerry Moore, 15 years old. He raised in 1912 on an acre of ground 228 bushels of corn. Jerry Moore had no predecessor, his only spur was ambition fed and fostered by competition. He just went at it to grow the most corn he could on an acre of soil. We have only to rouse ourselves and by co-operation seek out the best methods.

That is what we are trying to do in this matter of making the electrical contracting business a profitable calling. In the facts cited there is an object lesson, for everyone of us present. Why not try for a better way?

Secretary May's Report

Mr. Chairman, Gentlemen,—It gives me great pleasure on this occasion to make a report to this first annual meeting of the Master Electrical Contractors' Association of Winnipeg. It is my intention to make this report as short as possible so as not to take up any valuable time which will be

Mr. J. R. C. May, Secretary.

used to better advantage later on, and will just outline some of the work that the association has been doing. Committees were formed to manage the affairs of the association, one of which was the licensing committee. We all recognised that this was a hard question to deal with and that it would have to be handled very delicately. The matter has been taken to the proper quarter and although we are not in a position to make any definite statements, I believe that to-day we are nearer to official recognition and control of electrical

contractors than ever before, and that in the near future the question of the incompetent electrical contractor will be a thing of the past. We have started things on the right road and it is now up to us to push the question to a grand finale. Another committee was formed to take up electrical matters with the architects. The architects were informally approached on several subjects of vital importance, but the committee deemed it advisable to defer this business until such time as the more important matter of licensing had been satisfactorily dealt with. A committee to interview the jobbers was also formed with a view to securing co-operation from the supply house end of the trade and this committee met on several occasions in conjunction with the jobbers and discussed matters, and I think I am voicing the sentiments of this meeting when I say that never before in the history of the electrical trade in Winnipeg, has there existed such a feeling of friendship, and the recognised need of co-operation, as there exists to-day between the jobbers and contractors. We hope that after a little more discussion matters will be so arranged that the jobber and contractor will be mutually satisfied that the electrical contracting trade and the electrical supply business is still a trade and business worth following. The association also has from time to time invited travelling manufacturing salesmen to demonstrate their goods at their meetings in an endeavour to avoid the individual canvas and the wasted time and annoyance often caused thereby and if the jobbers will notify the secretary of any such salesmen in town we will be only too willing to accommodate them.

I think I have briefly outlined what has been done in the past and although to the casual observer, it may appear that nothing exceptional has been accomplished, yet taking into consideration the obstacles that we have had to contend with and the hard road to grind, we have succeeded in laying the foundation, and we hope that future results may be such that we will feel that our time and energy has been well spent. I will now conclude my remarks by saying that although business conditions now are not of the brightest, we look forward, without fear of contradiction, to more prosperous and harmonious times in the electrical trade for Winnipeg.

Efficiency in Contracting Business

By J. H. Schumacher*

Efficiency is defined in the latest edition of the dictionary as "The state of possessing or having acquired adequate knowledge or skill in any art, profession or duty." Hence it is readily seen that most electrical contractors are not working at very high efficiency.

The art or profession of electrical contracting is the newest and youngest in the contracting field, and the materials and methods are changing the most rapidly, and to keep up with this marvellous progress, the contractor has naturally been negligent in looking into the best and most efficient methods of conducting his business. The older contractors in the business have thus set a poor precedent for the younger members entering the profession, and the business as a whole has comparatively dropped to a rather low state in a gradual way, so that the other building professions have placed us at the bottom of the list in their considerations.

It therefore behooves us all to look into our present state, both from a retrospective viewpoint as well as having our eye on the future.

In the past, the conditions have made competition turn into rivalry, each contractor trying to put his rivals out of business, and keeping as far away from them as possible in both a business and social way. Other lines of business have passed through these vicissitudes and found that co-operation and not rivalry were conducive to developing the business as a whole on a better basis, and concurrent better financial and business standings of the individuals in the business.

In looking into other branches of the electrical business, we find great strides have been made in efficiency. Central stations are and have been developed to the highest possible points of efficiency thus reducing costs and giving better service. Electrical manufacturers by co-operation have developed and changed their plants and processes of production to the highest possible efficiency, so as to give us cheaper and better materials. Many plants are employing efficiency engineers to develop their plants to a higher point. The National Board of Fire Underwriters and the various Inspectors' Associations are co-operative to bring about more efficient results. As the electrical contractors are closely identified with all the above interests, they must also fall into line to keep up with the new evolutions.

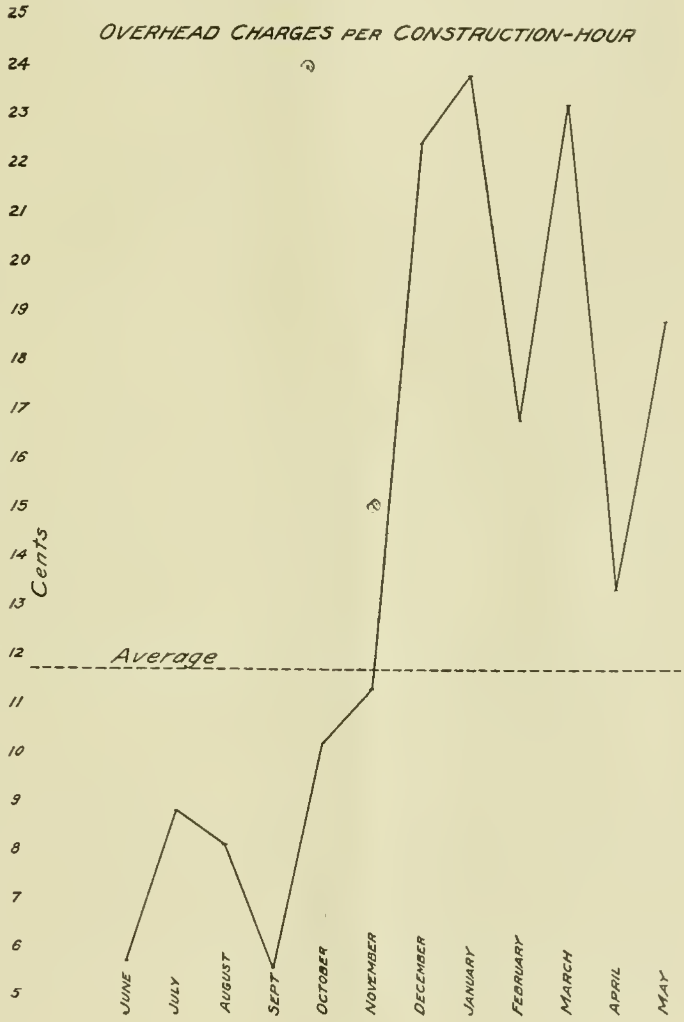


Fig. 1

The considerations in this talk are meant to apply principally to the contracting business in Western Canada where building construction and the demands of the trade having become so diversified are such that each contractor must specialize along some particular line of construction.

It is found very expensive and detrimental to maintain an organization, that would be able to wire office and public buildings, houses, to handle a fixture business, and to conduct a motor repair business. You will notice on inspection that the most successful contractors at the present date are those that have confined themselves to as few branches as

* Schumacher-Gray Electric Company, Limited.

possible. While our portion of work in a building has to be installed with the greatest care against fire and life hazards, and with the greatest utilitarian requirements it only averages about 2 per cent. of the total cost of the building, and this should make us aware of the fact that our work and business has to be handled in a most efficient manner to get the best results for our customers and the public, as well as the best financial results for ourselves. We might take a lesson from our manufacturers, as you do not find any one firm now making wire, conduit, porcelain goods.

This is an age of specialization in any art or industry, and a contractor must govern himself accordingly, by perfecting an organization with the necessary technical and practical requirements, giving the ability to efficiently conduct certain branches of the business. After determining the particular branches he intends to follow, he must see that he has a complete and well arranged stock, to take care of immediate demand on jobs. He must further have a systematic method of checking the stock from time to time, which will allow him to make standard package purchases, thus making his capital work to the best advantage. Thus you are reminded that a contractor must have a certain amount of financial responsibility to conduct the business properly, and if he is not extended too much credit by jobbers, he will keep better in touch with his financial resources, as well as his purchasing. He will see that his contracts are so made that he can insistently and promptly collect his accounts, so as to keep his stock as low as possible and not have to ask for too much credit from his jobber to keep his work going.

The Electrical Contractors have been considered as a class as poor credit risks, but this has been brought about by the jobbers giving unwarranted credit in the past to men that had probably good ability to perform labor, but no idea how to conduct business. This poor judgment in credits on the part of the jobber has caused himself losses as well as helped to put his particular contractor friend out of business, which on the whole, with its many repetitions, has brought about a feeling of uncertainty toward the legitimate contractor. This condition must be mastered by the jobbers themselves by looking into the merits of each individual credit risk, and not allowing the spirit of competition to enter into the credit, which generally turns out disastrous for the jobber.

Have Proper Accounting System

The contractor must have a proper accounting system, that lends itself to analysing his business and determining unit costs. In analysing and studying your business, you may find bad germs, just as a doctor does when he makes a diagnosis of a disease, and then there is a chance of counteracting the trouble. Many men who never analysed their business and thought they were getting along well, have been surprised when a bailiff walked in and took inventory and locked up the doors. Many of these men cannot understand it and think a great injustice has been done them by their creditors.

Referring to Curve 1, we find an interesting analysis of overhead costs per hour spent by workmen on construction. This is a typical cost curve in this locality, and in itself shows conclusively that the low rates generally charged per hour to customers, is at about cost or with but very little profit, when considering the business over the entire year.

If we could run our business continually at a good load factor for the 8,760 hours during the year, we could get the most out of our investment, but business is run so that we can only work 2,500 to 3,000 hours, so we must make these few hours most efficient.

Inasmuch as the greatest part of our time as contractors is spent in estimating work of which we only get a very small proportion, it is necessary that we employ methods and equipment necessary to save time which will be reasonably and consistently accurate. To eliminate guess-work, work must be estimated in the Unit Cost System, and detail records must be kept on work that is under construction or completed to get these unit labor costs. The unit system of estimating allows the contractor to check up his work during its progress at any time, which is a great benefit to himself at all times, as well as creating a moral influence on the workmen.

Considerable time is saved by making material cost curves, as shown by Curve 2.

Instruments such as the rotometer, tallymeter, slide rule, adding machine, etc., will be great time savers, and will easily pay their cost in a short time in the labor saved, and produce greater confidence and accuracy in the individuals using them.

A great deal more attention should be given to the making of detail plans for all work, as they will make a closer link between the job and the office. A plan will often serve well for any alterations or additions in the future, avoiding the necessity of making an examination of the wiring in the building. It also takes a great deal of responsibility from the workman on a job, and allows him to do a better day's work.

Care should be taken to produce neat appearing and intelligent plans, and a good system of filing plans should be devised. If this part of the business was better developed it would tend to bring about the long looked for scheme of uniform plans and specifications.

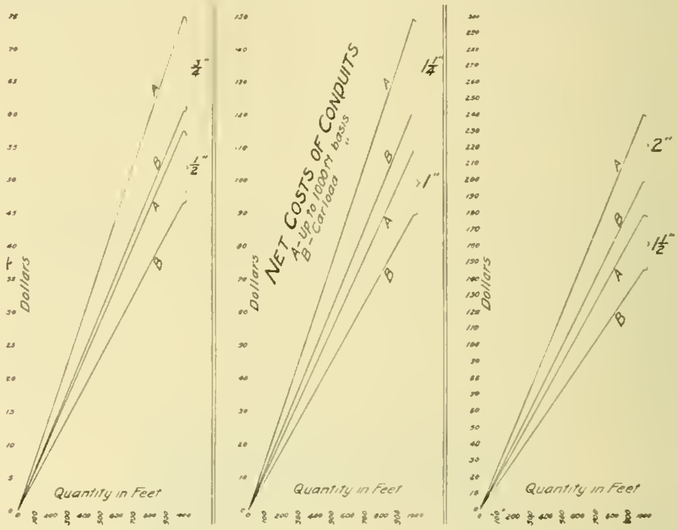


Fig. 2.

It has long been said that two heads are better than one, provided you put them together, in other words co-operate. Co-operation will bring men together to exchange ideas and opinions, which will broaden the intellects of the men, and in turn make them more progressive, which in turn will make the business in which they are interested more progressive.

If we conduct our business in the temple of efficiency which is built on the foundation of co-operation we will find that we are giving a square deal to the public and ourselves.

The genemotor is an ingenious Canadian General Electric device for starting and lighting Ford cars. The name signifies a unit combining the functions of a generator, which furnished the primary current required for starting the car, and operating head, side and tail lights, as well as those of a motor for spinning the engine. The genemotor is about 10 inches long, over all, 7 inches in diameter, and weighs about 52 pounds. It is supported on the right hand side of a Ford engine, viewed from the front, by a malleable iron or steel bracket which is secured at three points. A storage battery is employed to accumulate current while the car is in motion for supplying the starting motor and lighting system when the car is at rest.

Competition Among Contractors

By S. A. Barber*

Early methods of electrical merchandising were limited in effectiveness because the stock then handled consisted of only standard supplies and fittings which could not be made features of new business campaigns. When an opportunity is afforded to make the electrical supply store and show window attractive with displays of household devices, ornamental fixtures, etc., the dealers are handicapped by the central station companies selling supplies at prices which permitted of no competition. It was logical for the electric-service companies to sell supplies at wholesale and even give them away when electricity was first being introduced and a struggle was being made to supplant gas. But, now, in fairness to the contractors and dealers whose legitimate business it is to sell supplies, it seems that central station companies should limit their field of business to supplying energy only.

When the electrical business was first being built up central station companies maintained large business-promoting staffs and paid attractive commissions in addition to salaries to members of the staff for every energy contract secured. Houses were even wired for nothing to induce people to use electric service. A considerable portion of the burden of securing new business was taken off the central stations when electrical contractors sprang into existence, as the latter were necessarily compelled to connect the buildings which they wired to the electric service company's distributing system. For this service the contractor received no recompense from the central station company, even though the company was enabled to reduce its business promotion expenses thereby. Instead of the contractor being allowed to furnish all of the apparatus and supplies which might be required in buildings wired by him, as time passed on the stations and wholesale supply dealers quoted such low prices on supplies that the contractor became unable to make a profit on what is his legitimate business. If this condition did not exist, a contractor might have a life-long customer in the person whose building was wired and build up an electrical supply business which would bring him a nice profit without inflicting a hardship on anyone.

Since the price of tungsten lamps is decreasing and their life increasing, lamp renewals are no longer a factor in securing or holding central station business, so that electric service companies might as well stop the practice and allow dealers and contractors to profit by the sale of lamps. By doing this the electric service companies would be able to eliminate the lamp renewal department, cutting down overhead charges, labor expense, etc., and devoting such savings to a reduction of rates. If there were a profit in selling electrical devices and supplies (and there isn't in cities where they are sold at wholesale or below cost) contractors and dealers would have an incentive to do campaigning, and electrical apparatus would be given as widespread distribution by them as central stations are now giving it.

Should be Co-operation

There should be co-operation between the central station and dealers, the former introducing new apparatus and informing the public where their nearest supply dealer is stationed, and the latter supplying the goods. Electrical merchandising can be extended to include the selling of a contractor's services. As the Underwriters' stamp must be on all wire and conduit installed in buildings, there is little difference in the quality of material which a good and inferior contractor can furnish. The superiority of one contractor over another consists in the method of installing the apparatus. Every contractor should be compelled to qualify himself before inspection is allowed on his work. The work done by contractors could be relied on more than it is at present if pawnbroking of electrical contracts by the petty contractors could be prevented. Cases have arisen where competent contractors have been deliberately underbid by some inferior contractor who knew that the work could not be accomplished according to specifications at the sum quoted by him. Being the lowest bidder, however he generally secures the contract and then assigns it to a supply house, with the agreement that the latter shall pay him in instalments for supervising the work. Not always being acquainted with the job or the fact that the contractor has under-estimated the cost of doing the work, the supply house and the party letting the contract are made the goats of the deal. The low-bidding contractor starts the work in apparent good faith and after receiving several payments which are in excess of the value of the work done he finally declares that more than the sum contracted for must be paid before the work can be finished. If the contractor fails to receive the additional amount he disappears, leaving the supply house to face the task of completing the job at a loss.

Speaking for the Electrical Contractor at a dinner given by the Edison Electric Illuminating Company, of Brooklyn, on February 7th, Mr. Louis Kalisher, president of the Electrical Contractors' Association, of Long Island, said that of the central station, the manufacturer, the supply house, the consulting engineer and the contractor, the latter is the only one brought into direct contact with each of the others as well as with the most important individual of all, the customer.

Contractor Must Know Many Things

Moreover, the contractor must possess a number of accomplishments. He is expected to know all forms of the lighting company's contracts and the service available in all parts of the city. He must be familiar with every device and appliance on the market (one large New York company manufactures over 57,000 devices alone) and must know where to get the material best suited for the work at the right price. He must also be familiar with all of the Underwriters' or the city departments' requirements, and sometimes must divine the interpretations of the rules by individual inspectors. A good knowledge of building construction must be his. He must be able to size up workmen and at times know what the customer will need for future expansion.

In addition to the above, the electrical contractor must be equipped with a complete set of measuring instruments, in order to be able to make accurate tests on engines, generators, motors, etc., locate troubles and give advice. If he is awarded the contract, he must back his judgment with his own money as to the cost of labor and material to do the work. He must follow at times an ambiguous specification, and if possible complete the job to the entire satisfaction of all parties concerned. The electrical contractor is thus the stock absorber of the electrical business. From the time he spends his first money estimating on the job until he puts the final payment in the bank he has been hard at it.

Local competition as it has been demonstrated within the last few weeks, shows that either lack of knowledge or rotten business methods has been prevalent among some of our prominent contractors, and as long as this continues the most desired word to be found in connection with our development is lacking, or in other words "Progress."

The Electrical Contractors' Association has been formed to gather together all the legitimate contractors of the city with the aim in view to elevate the business from its most deplorable condition. In endeavoring to do so we regret to say that we have met with considerable opposition from reputable contractors who have failed to co-operate with us in our effort to right the wrongs of the present as well as the past, and as long as one firm cuts his price down to meet

* Union Electric Company Winnipeg.

some other competitor who slashes his price for the sake of a job irrespective of profit or loss, the trade will so long stay at the bottom when it ranks above many others in the building trades. This does not apply only to the contractor; it can be found in the ranks of our jobbers and we feel that the jobber sets a very bad example to contractors who have a tendency to cut prices.

We also have to contend with the American contractor, who comes into our midst and cops off our very best jobs. On looking over a job which has not long been finished we noticed that switches contrary to our local by-law concerning panel boards are allowed to be used as, if I interpret the clause rightly, it is as follows: "Except in the case of service switches, switches on switchboards or time switches, knife switches will not be accepted on systems of 300 volts or less for the control of currents of 30 ampere or less. Knife switches on panel boards or in cabinets that are not used for the control of light may be knife style provided the user cannot make contact with any grounded material, and these switches are for the control of light and within easy access of grounded material."

The Jobber in the Field

By H. W. Billing

The subject chosen by your President, namely, "The jobber in the field" is necessarily a broad one, particularly in the application of electricity. This in view of the fact that since the exceptional development during the past few years has been so rapid and so broad that I question if we can find a single branch of commerce throughout the country which does not require in a greater or lesser degree electricity in some form, and in view of the fact that the gentlemen present are all associated with the allied electrical lines, we will consider the jobber in the field as applying to allied electrical lines.

As stated before, the dealer and the contractor are forced to apply electricity, and its equipment, to practically every branch of commerce. This demands of every individual associated therewith, and who hopes to make a success of his business, a maximum of energy, close application to detail and a mind absolutely free from petty bias. A maximum of energy is necessary in order to keep pace with the very keen competition which we experience in all branches of industry. This does not apply to the electrical business any more than any other. Clear mental vision—and by this I mean that our minds must be kept in a state where we can realize before it is too late any of the weaknesses which are developing from time to time and which if our mind is in a proper state will not only show the weaknesses, but also the remedy. A mind free from petty bias is one that we in the electrical business must cultivate, and of we will all determine to study the other fellow a little closer we will find that he has a greater number of good points in his composition than we ever admitted. This particularly applies to the electrical business, in view of the great number of companies entering the field who attempt to start with a ridiculously small capital and sometimes a more ridiculously limited experience, and when we see this going on from day to day we are liable to overlook the man who is making an absolutely successful business man because we have permitted our minds to become biased in studying the actions of the unfit.

As stated at an earlier point in this paper, I believe you will wonder what application my past remarks have to the jobber, and in this I can freely state that the jobber's position is controlled to a great extent by the aggregate business knowledge of the dealer and contractor, for, with but a few exceptions, it is to the dealer and contractor that we look for our source of distribution and in the event of the dealer and contractor not keeping abreast with the times, our position becomes more hazardous in more ways than one would think from a casual survey of the situation, and I would like to draw to your attention a few of the conditions which tend to increase the troubles of the jobbing house, and a more than corresponding decrease in profits, and I might state at this point very freely that the jobber is in the field with the view of making a profit and it is some struggle to make a legitimate one.

One instance where the dealer and contractor innocently reduce the profits of a jobbing house is in placing orders for material, which, upon arrival is found to be unsatisfactory for his service, either through technical reasons or artistic reasons. When an instance of this kind occurs where the dealer or contractor is a good customer, he states that the jobber should take that material back into stock in view of the fact that his trade is worth it. I might here illustrate a rather amusing instance where an order was placed with a jobbing house for 10 28 circuit panel boards equipped with switches and fuses, also including boxes, when as a matter of fact the requirements on this order were 28 10 circuit panel boards. You will all agree with me that when a big building has been designed by an architect, panelboards are to a great extent special, particularly 28 circuit panelboards, and an error of this kind is expensive, but more frequently this condition is evident from small special parts that go together to make a complete installation where a dealer over-estimates in his purchase the number required for a given job. When a job is complete, the jobber is asked to take the surplus into stock.

The Jobber's Responsibility

Another feature applies to prime movers or secondary movers as I believe a motor should be called, and in this instance I believe it would be well for the dealer and contractor to become more familiar with the actual requirements of apparatus to be driven by electrical power, and I can say without prejudice that it becomes particularly necessary for the jobber or manufacturer to get on the job when the power apparatus is being ordered with the view of definitely deciding what type of equipment should be called for, this in view of the fact that the contractor, as a rule, has not made a study of the situation to define clearly and definitely what type of equipment is necessary in order to meet the demands, and in this branch I would strongly recommend that the dealer and contractor exert as much effort as possible with the view of keeping abreast of the advancement in electrical power equipment and he will find that this condition will be very interesting and very much to his benefit financially, for he will not only be in a position to arbitrarily dictate what he wants to purchase but he will see a great many sources of revenue from his own point of view that are being passed by at the present time, and he will find by close application to this branch of the electrical field that he can come very close to his customers, by improving from time to time various methods of economy which can be accomplished by the application of more up-to-date equipment. Once a dealer or contractor proves to his customer that he has his interest at heart financially, he has a customer established for all time.

Why is a jobber necessary, might be asked?

In the early days of civilization when communities were small and scattered over vast areas with little or no methods of intercommunication, it was a habit of the races to subsist on the products of their individual efforts. Through the process of evolution, certain artisans or producers became more proficient in the production of miscellaneous requirements of the race. At this stage of civilization barter and trade were established by the transfer from one artisan to another of the products of his labors; all of which is within the confines of individual communities. As general conditions im-

* Northern Electric & Manufacturing Company.

proved it became apparent to other communities that they had been existing without the benefits obtained from the development of other communities. This resulted in barter and trade between communities. Further, through the evolution of commercial development (and I might say that a great many years must have elapsed up to this period) certain communities determined on what might be considered foreign trade relations. This you will realize from our present method of commerce must have been a very slow procedure. However, the final development resulted in the centralization of different commodities in each community.

Centralization of Supplies

As an illustration of the effect of this centralization of one branch of commerce, I might state that in the Western territory of this company we assemble materials from not less than 500 different sources carrying, as illustrated by inventory, over 5,000 different items, every item of which must be called for at least four times a year, otherwise it is not considered satisfactory stock. This, I think, will more clearly illustrate the necessity of a jobbing house than any statistical information that can be compiled.

I have tried to illustrate in the above the reason or necessity for the jobber, or as referred to in the immediate past, the wholesaler, and I would like to emphasize the statement that the jobber is, or should be, the wholesaler, but from information compiled it becomes rather hard for us to believe in view of methods of ordering that our position in the commercial world is that of a wholesaler, and I believe that if the gentlemen present will study more closely the principle of wholesale ordering rather than retail ordering, increased profits will be the result of all concerned. I would strongly recommend to you all that standard package quantities be ordered when possible, either as individual items or assorted items where this is consistent with the character of the material required. It would also be well to consider the time element when placing orders. By this I mean a schedule of shipments so that material will not be on your hands a greater length of time than is necessary for satisfactory installation at the proper time, and in this way you will be more apt to be reimbursed promptly for your outlay, by your customer.

You will find that by adopting a scheme of more careful ordering, both as to the assembling of orders and date of delivery, your profits will be increased, and by way of illustration I might refer to you the type of orders which I believe can be considered as applying to the electrical jobbing trade in general in this territory: About 22 per cent. are less than $5.00; 15 per cent. between $5.00 and $10.00; 18 per cent. between $10.00 and $25.00, and the balance $25.00 and over, and I believe you will agree with me that an order to a jobbing house, or wholesale house, less than $25.00 should be considered a retail order.

Jobbing on Retail Basis

In view of the above information, is it surprising that there are occasions where jobbers determine that the actual sale on a retail basis is to his advantage, in view of the fact that the so-called dealer and contractor in many instances purchases on a retail basis as to quantity, insisting on wholesale prices. Personally, I do not favor this practice, and the only solution apparent at this moment would be to consider the matter in all its phases, discuss the situation in a determined way with an outlawed jobber who practiced such methods. In the event of his failing to comply with the requirements of a legitimate jobber, the cure for his malady is entirely in the hands of a few of the principal dealers and contractors in any community. This practice should not be tolerated, and if permitted to continue will sooner or later be the greatest disturbing influence and the greatest loss of profits experienced on the part of the dealer and contractor.

Before closing I think it would be to our mutual benefit to raise the question of credits, not from a contractor's point of view, but credits as applying between jobber and contractor. The question is often asked of me "What basis do you adopt as the means of determining a line of credit that should be extended?" This question is not easily answered, for the personal equation exerts a decided influence over a decision as to whether credit will or will not be extended. Many conditions must be considered before a decision has been reached. Some influence is effected by commercial reports. We feel, however, that commercial reports are not infallible, prticularly as to a man's capability to perform certain duties in electrical commerce. A statement of a prospective customer's financial standing is of course interesting, but not final. A man's capacity to complete work which he has started—to complete work in a rapid and satisfactory way to his customer bears a very important influence in the decision. The whole credit situation can be summed up as follows: moral worth—practical capacity—financial standing.

Standardization of Plugs and Receptacles

The Electrical Department of the city of Winnipeg, through its city electrician, Mr. F. A. Cambridge, is taking a decided stand regarding the much discussed question of standardizing plugs and receptacles. In a letter just sent out to the various jobbers of that city, Mr. Cambridge explains the action that has already been taken by the National Electric Light Association, in deciding that the Edison screw type of wall and baseboard receptacle, being undesirable because of liability to shock, etc., should be eliminated. Mr. Cambridge further warns the jobbers against overstocking this type of receptacle, as it is the intention of his department to prohibit the use of them after a certain date, which has not yet been decided. The letter received by the various jobbers is worded as follows:—

Gentlemen:

You are doubtless aware of the movement that is now on foot in the above connection. At a conference held in the National Electric Light Association Headquarters, New York, on February 15th last, it was decided that the Edison screw type of wall and baseboard receptacles, being undesirable because of the liability of shock, danger of short circuit, etc., should be eliminated, the discussion thence resolving itself into the question of the rival merits of plugs of the straight pull type and those that can be withdrawn at an angle.

At a subsequent meeting on March 23rd, the various manufacturers of each of these types of receptacles reported that progress was being made towards an agreement of standardization and it is very probable that in the course of the next few months the necessary agreement will be consummated which may result in reducing the number of types to two instead of 15 or 20 which are now in use.

This department brings the above to your notice for the reason that it is heartily in sympathy with this movement, not only from the standpoint of safety to life, but also as tending to eliminate unnecessary minor service troubles.

For the above reasons I beg to draw your attention to the inadvisability of stocking up of additional receptacles of the Edison base type, as it is the intention of this department to prohibit the further use of same in new installations after reasonable notice in respect to existing stocks has been given.

I would be glad to discuss this matter with you so that an understanding may be reached, as it is probable that Canadian manufacturers were not represented in the conferences that have so far taken place.

Yours truly,
(Signed) F. A. Cambridge,
City Electrician.

Winnipeg, Man., April 7, 1915.

Good Lighting Pays for Itself

"Eye Comfort," in its last issue, makes an interesting computation of the low cost of good lighting as follows:

Good lighting in the average office costs nothing if it saves 3 1-3 minutes per day. Lighting has been so poor for ages that we accept faulty systems as the best we can get and are not conscious of the inconveniences, because they are not so harsh and disagreeable as cold hands and feet, headaches, colds and nausea caused by insufficient heat, poor ventilation, and unsanitary conditions.

However, improper lighting does cause appreciable loss of efficiency of the eye, whether the individual is conscious of it or not; causes him to make errors; is responsible for accidents; causes loss of time in the effort to avoid some of the evil effects of glare from glossy paper and pencil marks, sharp shadows and glare from the lighting units themselves. In addition to these daily losses, there is a progressive loss, namely, the dimming of the eye sight. Gradually the eye sight becomes bad, requiring the use of glasses, and the services of the most valuable men, the men who have been with the firm, working under bad lighting conditions, for years, are seriously impaired or lost entirely.

Hence, even when viewed from the dollar and cents standpoint only, good light is the cheapest.

Suppose we forget all about the many humanitarian and hygienic reasons why we should have improved lighting, and consider it only from the cold business standpoint. Viewing the matter in this way, a lighting installation represents an investment or expenditure, which must yield an adequate return. Let us take an actual case and make a few calculations.

An accounting room 60 x 40 feet accommodates 50 clerks. A new installation is installed at a cost of:

Fixtures	$180.00
Lamps (500-W. Tung.)	21.60
Installation Labor	20.16
Total	$221.76

The number of hours work under the artificial light is an average of 2 hours per day, for 300 days per year, or a total of 600 hours per year. Hence the number of kw. hours energy consumption per year is 1,800.

The cost of operation per year is as follows:

1. Annual Fixed Charges.	
Interest on Total Investment at 6 per cent.	$13.31
Depreciation on equipment, insurance, etc., at 15 per cent.	33.26
2. Annual Maintenance Costs.	
Labor for monthly cleaning, 10 cents per fixture	$28.80
Lamp renewals (life of lamp 1,000 hours)	12.96
Repairs and breakage (assume at 5 per cent. annually)	11.09
3. Annual Cost of Electrical Energy.	
1,800 kw. hrs. (.05 per kw. hr.)	$90.00
Total annual operating cost	$189.42

The average salary of the 50 clerks is (say) $10.00 per week. Hence the total payroll per year aggregates $26,000. Of this amount the cost of operating the lighting system is but .73 of one per cent. On the assumption that the clerks work 44 hours a week, the average wage per hour is 22.72 cents. Therefore, the annual operating cost is the equivalent of 833.71 hours work per year for all the men, or 16.67 hours per year per man. Reducing this to minutes per day per man, we get 3.33 minutes. In other words, if the improved lighting eliminates lost time to the amount of only 3.33 minutes a day per man, the lighting system pays for itself.

Scope of Illumination Practice

The "Scope of Illumination Practice" was the subject of a paper read by Mr. E. N. Hyde, of the Northern Electric, Limited, at the meeting of the Montreal Electrical Society, held on April 5, at McGill University. Mr. Hyde advocated the formation of a Canadian Society of Illuminating Engineers, and referred to the pioneer work of the Electrical News on this subject. Illuminating engineering was now more widely recognised as a profession as the result of the formation of the American society, and men were more thoroughly equipped to deal with the subject. Mr. Hyde indicated subjects, a knowledge of which was essential to the qualified illuminating engineer; these include details of the cost of installation, chemistry, the effect of light on the eye, the value of shadows and contrasts, an appreciation of architectural values as applied to lighting schemes, and also mechanical and electrical data. He insisted upon the importance of planning lighting installations which were in accord with the surroundings, so that in residences, for instance, there would be a harmonious blending with the architectural scheme. Mr. Hyde also discussed in detail recent developments on the technical side of electric lighting, explaining the construction and action of the nitrogen filled tungsten.

Hydro Inspection Department's New Offices

The Electrical Inspection Department of the Hydro Electric Power Commission of Ontario is now situated in a new office on the ground floor of the Continental Life Building, known as No. 53 Richmond Street West, where they can be reached much more conveniently than heretofore. The new office is occupied by Mr. H. F. Strickland, chief electrical inspector of the province, together with his inspection staff.

The "Three Pyramids"

The Canadian National Carbon Company, Limited, 99 Paton Road, Toronto, have issued an attractive little circular entitled "In the Days of Rameses II." This circular contains an interesting little bit of Oriental history, which explains this company's reasons for choosing "three pyramids" as their trade mark.

Have Moved Headquarters

The Western Lumber & Pole Company, whose general offices have been located at Denver, Colo., for the past 15 years, advise that they have moved their headquarters to Spokane, Wash., where they now have new and commodious quarters in the Peyton Building. This concentration of their selling and shipping offices at Spokane, where they are in close touch with their different cedar pole yards in British Columbia, as well as in the States, enables them now to assure despatch in the handling of orders.

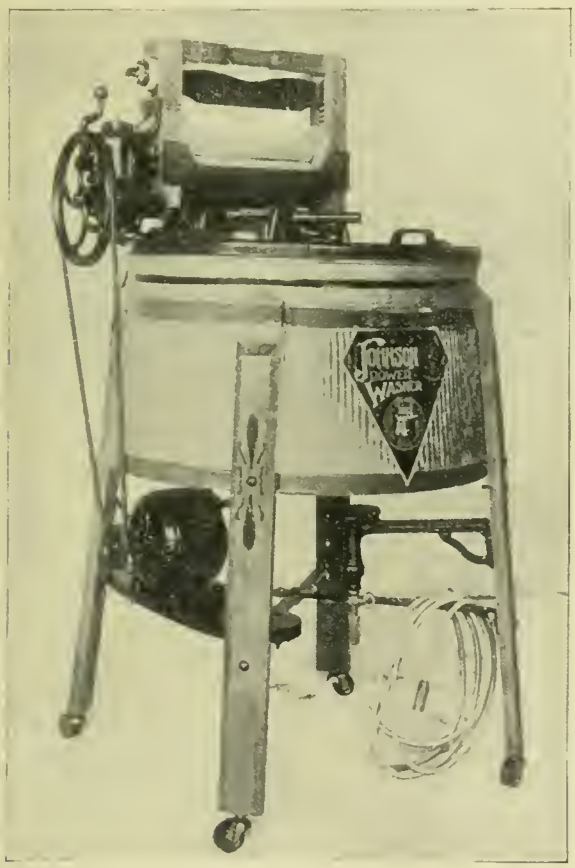
New Sales Office

The Lindsley Brothers Company have opened a general sales office at Minneapolis, Minn., from which point they believe they will be in much closer touch with their Eastern trade both in the United States and Canada, as it will mean a saving of from three days to a week in the correspondence. In connection with their Minneapolis office they are establishing what they claim will be the largest exclusively red cedar pole yard East of the producing section. They will carry a complete stock of poles at all times and will be able to give their Canadian customers quick delivery of rush orders when necessary. Their yard will be located on the Soo Line tracks, which have direct connection with the C. P. R. into Canada which again will mean a big saving in the delivery of rush orders. The slogan of this company is "Good Poles Quick," which they will now be able to live up to more fully than ever.

What is New in Electrical Appliances

Johnson Power Washer

The electric washer illustrated herewith is stated to be one of the most satisfactory washing machines on the market. In its design many small but important labor-saving details have been incorporated and the efforts of the manufacturer have all been concentrated on the production of a simple, efficient machine that will do the family washing in the shortest possible time with the least expenditure of the housewife's energy. It is claimed to be the only rotary electric washer that stands high enough to be used alongside of the ordinary stationary wash tub, allowing clothes to be passed directly from the washer, through the wringer and into the rinse water. Six feet of hose is furnished with the machine, through which hot water is carried into the washer or the dirty water drained from the machine, thus eliminating all lifting of water. The outlet is located in the centre of the tub, alolwing all the water to be drained. The tub is made of rust-proof galvanized steel. It is sanitary and will last for years. A gas burner and ten feet of metal gas tubing are furnished with each machine, affording the most economical and convenient way of heating the water. Each machine is operated by a motor so mounted that it can be disconnected in an intsant and used for other purposes. The cost of power at average rates for an ordinary family washing will not exceed three cents. The power transmission is made of steel and requires no attention except an occasional oiling. The control is simple; by shifting a small lever, the wringer can be made to run in either direction. The motor is strong enough to run both the washer and the wringer at the same time, so that clothes can be wrung back from the rinsing or bluing water while a tubful of clothes is being washed. The machine is quiet, clean, safe and durable. All parts are standard and repair parts can be furnished on short notice. The washer is made by the Johnson Electric Washer Company, of San Francisco. Westinghouse electric motors are used on all machines.



A New Labor Saver.

The Development of High Tension Insulators For Station Service

By Mr. H. W. Young, President Delta Star Electric Co., Chicago.

The development of high tension supports for use in power house or sub-station equipment and wiring, is well illustrated by the group of 22,000-volt porcelain insulators shown in Fig. 1. In the early stations, petticoat insulators were usually employed, as insulators specially designed to meet the conditions were not commercially available. Practice soon demonstrated, however, that this type of insulator occupied far too much space, and it is now practically obsolete for indoor service.

The next form developed was the pillar type, which presented a neater appearance than the petticoat design, and occupied much less space. A serious objection to the pillar type insulator soon developed in practice, due to the fact that in central station service it is often necessary to materially increase the capacity of bus-bars or other equipment, and in some cases, even change the style of mounting. With pillar type insulators it was usually necessary to substitute a completely new unit, as the conducting parts were solidly cemented into the insulators, in turn cemented in a base. To

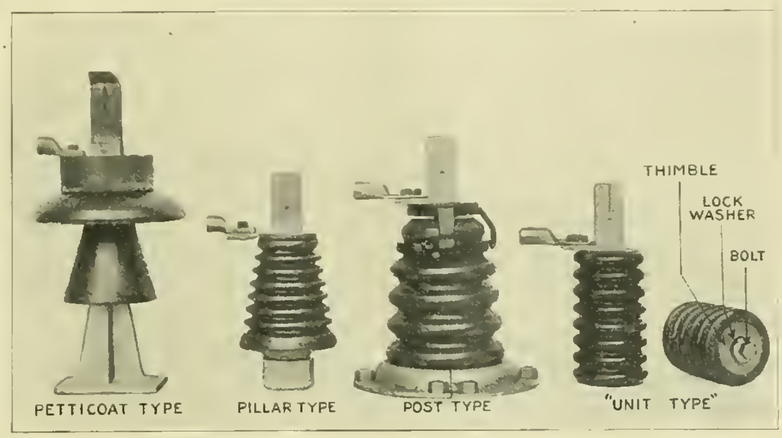


Fig. 1. Development of Insulating Supports.

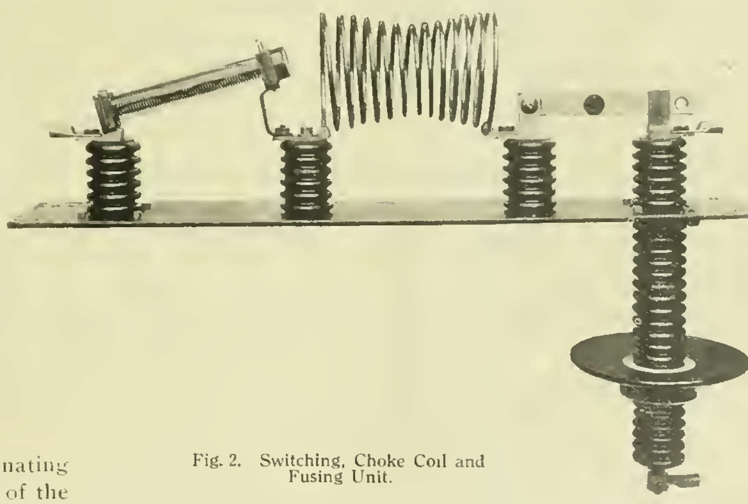


Fig. 2. Switching, Choke Coil and Fusing Unit.

remove parts, the insulators had to be broken, entailing considerable expense for labor and material.

The main objections to pillar type insulators were then overcome by the post type. In commercial practice the switch, or other parts, are fastened to a cap which clamps the insulator, making it possible to replace with other sizes or styles and still retain the use of the insulator and cap. As the insulator is secured to its mounting base by clamps, it is also possible to replace the base with other styles or sizes as occasion requires.

The post type insulator is at a disadvantage, owing to the fact that with a given height of porcelain the actual leakage surface is materially reduced. This is caused by the clamping parts, both at the top and bottom, which occupy too much valuable insulating space. Again, as the clamps and fittings at both top and bottom are wider than employed with the older pillar type insulators, greater clearances are necessary between equipment, and consequently greater space for wiring than would be necessary otherwise. This disadvantage is particularly noticeable where equipment is installed in expensive bus-bar compartments.

The final form of support, generally known as the "Unit Type," was then developed, and eliminated the objections to the preceding forms. This support consists of a corrugated porcelain unit, each end having a socket, into which is "key cemented" a threaded malleable iron thimble. By means of standard bolts any desired fitting can be secured to an insulator unit, thus permitting an infinite range of assembly. "Key cementing" thimbles into the insulator ends to receive fittings rather than clamping fittings around the outside, also maintains a maximum creepage distance, and insures a maximum factor of safety for a given height of porcelain.

The compact design of these modern insulators and their effective insulation factor is of great value when installed in compartments. It has been demonstrated that where too small air spaces exist, trouble may develop, due to static discharges, which produces ozone and nitric acid, this attacking metal fittings or destroying organic washers. With the improved insulators a very desirable high "space factor" is secured, and equipment can now be mounted in the smallest possible space consistent with safety. The freedom from overhanging projections, etc., materially increases the breaking distance to ground and between phases.

The commercial application of these modern insulating supports is very wide, permitting the constructing engineer to meet practically any condition arising in practice. Fig. 2 shows switching and protective equipment mounted on the same type of support. The ease with which a uniform bus structure and control system can be installed by means of the improved form of insulator support is readily apparent.

Improved Household Utility

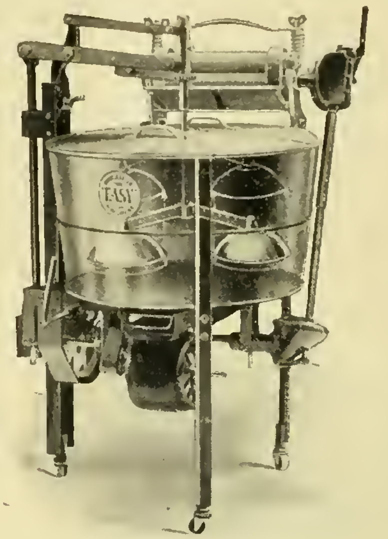
The Hotpoint Electric Heating Company are putting out a new household utility under the name of El Grillstovo, as illustrated herewith. This appliance combines the functions of a grill and stove, utilizing the principles of the open-coil reflector-type electric stove. The new appliance is in effect a

El Grillstovo.

combination of two articles in one—above the heating element ordinary kitchen utensils may be used; below, a special extra deep underdish is supplied with the equipment.

New Dodge & Zuill Electric Vacuum Washer

The illustration herewith shows the new Model "F" Washer recently added to the line of vacuum plunger washers manufactured by Dodge & Zuill, Syracuse, N.Y. A particularly useful improvement in this new washer is the provision that has been made so the plungers can be tipped back out of the tub where they are entirely out of the way after the



washing is finished, giving free access to the inside of the tub. This model has a capacity of six sheets, or the equivalent. The diameter of the tub is 23 ins. inside at the top, 20½ ins. at the bottom and the height is 12¾ ins. The bottom is fitted with a discharge valve for sewer or hose connection. The motor is of ⅛ horse-power capacity and is made by the Robbins & Myers Company, Springfield O. It is mounted directly under the tub where it is out of the way. All gears in the transmission are thoroughly protected by guards. The vertical bar which drives the wringer can be disconnected easily and dropped to a horizontal position for operating ice cream freezers or other equipment of this kind. A fitting for the ice cream freezer is supplied with each machine.

The Step-O-Lite

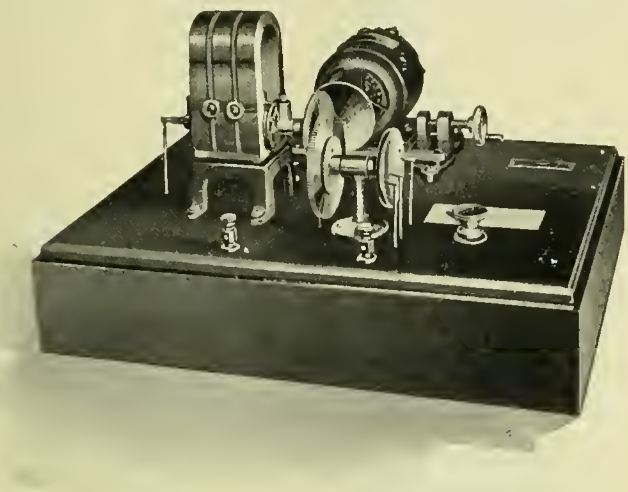
The Step-O-Lite is another attractive-looking battery lantern that has just been placed on the market by the Bass-Moody Company, of Peoria, Ill. The lamp is screwed into the socket shell and the centre or contact engages the zinc shell of the battery through a hole made in the cardboard carton. Any dry cell of the standard number 6 size can be used, provided it is a round carton. With ordinary intermittent use a single

Will last for months.

dry cell will last for months. Old batteries that have served their time for ignition purposes will still do many hours' service, it is claimed, in the Step-O-Lite.

Electric Device for Physicians, Hospitals and Sanitariums

The accompanying illustration shows a novel device for the use of electricity as a therapeutic agent. It consists essentially of a magneto which generates a sinusoidal alternating current, driven by a small motor. A decided advantage is claimed by the manufacturer of this machine over the older types which generate a uni-directional Faradic current. In the alternating sinusoidal current the current rises from zero to maximum, then returns to zero again and alternates, while the Faradic current has a break which occurs at the maximum voltage. On this account the Faradic current is painful to the patient being treated while the break in the sinusoidal current being at the zero point, is said to be practically painless. The Faradic current being uni-directional also produces chemical changes in the body while the alternating sinusoidal current it is claimed does not. The beneficial effect of the electric application is obtained through the



Electricity as a therapeutic agent.

exercise of the muscles treated. The electrodes are placed at the desired points on the body and the current is turned on gradually by means of a rheostat. As the voltage rises the muscles of the patient contract until maximum voltage is reached. As the voltage decreases the muscles relax. In this way a patient who is too weak to take any of the ordinary forms of exercise can be exercised without effort on his part. Exercise can also be given the involuntary muscles. The outfits are used in hospitals and sanitariums for the treatment of neurasthenia, weakness of the abdominal muscles, locomotor ataxia, arteriosclerosis, etc. The magneto is driven by a motor made by The Robbins & Myers Company, Springfield, Ohio. The equipment is manufactured and sold by The Sanitarium Equipment Company, Battle Creek, Michigan.

One-Man Rail Grinder

A rail grinder which requires only one man to operate it, has been placed on the market by the Equipment Engineering Company, of London, England. This grinder is designed for levelling rail joints, deepening grooves, and performing all other classes of grinding work required of an electric railway track system. The weight of the equipment is approximately 420 lbs. complete, the weight of the motor, which is balanced over the running wheel, giving the necessary pressure to the grinding wheel and relieving the operator as much as possible.

The machine is easily wheeled along the track by one man. Street obstruction is reduced to a minimum, as the maximum width of the machine is only 2 ft, and the ordinary highway traffic can use the side paving just as if no grinding were in progress. As but one rail is occupied at a time, it is easy to wheel the machine out of the way of passing cars, and put it on the track again as soon as the line is clear. The power is obtained direct from the overhead wire. The machine is operated by one man only, who stands in an easy upright position and moves the grinder forward and backward over the rail joints. The motor starter is within easy reach, so that the machine can be stopped instantly by the operator without the assistance required in the case of most grinders. The labor costs of operating this machine are said to be about one-half of those for other types, since one man only is required to work the grinder, with the help of a boy, if the condition warrants it, to ward off traffic and remove the trolley attachment when cars are passing. As the machine is of the mono-rail type, its bearing is instantly obtained; the second wheel is merely provided to carry the frame and is fitted with an adjustable spring sufficiently powerful to lift the grinding wheel clear of the rail immediately the pressure of the hand is removed, so that the depth of cut is regulated by the pressure of the hand on the shafts. The automatic cutout in connection with the starter is so arranged that the machine cannot be made to cut too deeply. This grinder is already in use on many systems in England and elsewhere.

A Shrapnel Lamp

Artillery is playing a greater part in the present war than ever before, and it is gratifying to learn that the allied armies, in the West at least, have established a decided superiority over the enemy in that respect, but the expenditure of ammunition is so enormous that it has become necessary to manufacture shells in Canada on a large scale for their use. This means one more reason why the interest of Canadians in the great conflict is increased, but although shells are referred to daily in the newspapers very few people have even seen one. Surprising as it may seem, they have

New C. G. E. lamp device.

been turned into household use by the Canadian General Electric Company, one of the companies engaged in their manufacture. Swords have sometimes been beaten into plowshares, but probably this is the first time that shells have been used to enlighten the world. A regular 18 pounder shrapnel shell mounted on a suitable brass base is fitted with an electric light and brass shade to make a very handsome reading lamp, and at the same time a realistic souvenir of the great war.

Beacon Electric Friar's Lantern

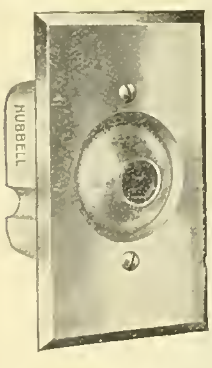
Another novelty in the way of an electric lantern is that shown in the accompanying illustration. The form of this outfit is that used in the old style friar's lanterns in which oil furnished the light. This lantern is equipped with an Aladdin primary battery and is guaranteed to give five hours

Electric Friar's lantern.

of continuous or ten hours of intermittent service. A mazda lamp is used. The metal parts of this outfit are finished in nickel, giving it a very attractive appearance. The outfit is manufactured by the Beacon Miniature Electric Company, 108 Duane Street, New York City.

New Hubbell Devices

The illustration herewith represents the new Hubbell flush receptacle with recessed plate consisting of catalogue numbers 3285 receptacle, 6286 plate, and 5421 cap. This device is equipped with the new Hubbell "T" slot contacts, permitting the use of 17 different types of cap. The receptacle and plate are recessed permitting the deep insertion of the



Flush receptacle.

Shade holder.

cap so that the top of the cap is flush with the plate. This equipment is handled in Canada by the R. E. T. Pringle Company.

The new Hubbell four-inch shade holder No. 6276, designed for use with brass shell mogul base sockets, is also shown herewith. This holder is attached to the socket by a clamp and screw arrangement which grips the socket upon the bead and provides rigid centre suspension for shades of any size. Ample means for ventilation are provided by 12 openings around the top making this a desirable device to use in connection with type "C" lamps. The illustration also shows Hubbell No. 3383 mogul base socket.

A Guaranteed Cleaner

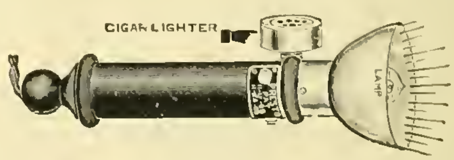
The electric cleaner illustrated herewith is a guaranteed article at a low price, said to combine all the features and luxuries in the way of minor refinements that are found on high-priced machines. The suction is powerful and direct. The motor operates on either a.c. or d.c. current and the whole machine is mounted on easy running wheels. The

An easy running machine.

equipment is complete including brush and other attachments. There is also an adjustable device whereby the rear wheels may be raised or lowered to suit the thickness of the carpet. The cleaner is manufactured by the Central Electric Company, South Fifth Avenue, Chicago.

Combined Lamp and Cigar Lighter

An automobile accessory in the form of a combination cigar lighter, acetylene lamp lighter and incandescent repair lamp, made by the Metal Specialties Manufacturing Company, of Chicago, Ill., is now on the market and has proven itself to be a most useful article for automobile and electric vehicles. The lamp is six inches in length and always at your elbow ready for use. The lighter is made of pure platinum



wire and is readily removable. Tips and bulbs can be furnished in different volts from six to twenty-one. There are separate ivory finish push buttons for the lamp and the lighter. The repair lamp is very handy for purposes of inspection, especially for making repairs on the road after dark. The ten feet of cord attached is sufficient for exploring any part of the machine. This item is illustrated herewith.

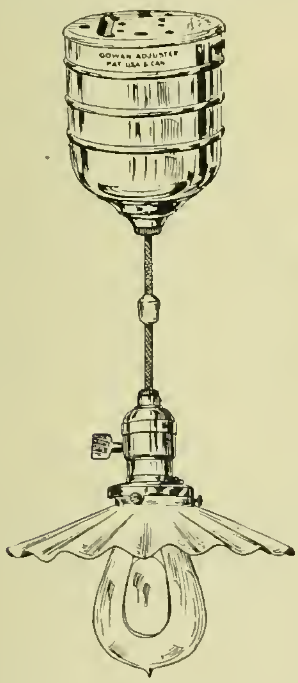
Manager James Anderson, of the Sandwich, Windsor & Amherstburg Electric Railway Company, has offered to construct a belt line by way of Lincoln Road and Ottawa Street, if his company is given in return a 12-year extension of their present franchise. Mr. Anderson promises that the belt line will be in operation by the 1st of October.

Crocker-Wheeler Fan Motors

The Crocker-Wheeler Company have paced on the market this year an additional type of 9-in. alternating current fan which embodies some novel features. In place of the usual rheostat lever for securing different fixed speeds, the speed is varied by rotating the core containing the windings inside of the fan housing. Not only can fine adjustment of speed be secured, but the current consumption varies with the speed, so that while the power consumed at full load is about 24 watts, the power consumed at low speed is approximately 7 watts. The fan is started and stopped by means of a push switch located in the base. It can be started and stopped at any speed at which it is fixed to run. Fan users will readily recognize the advantage of being able to place a fan at one corner of a desk and secure sufficient breeze for relief from hot weather, and at the same time not have all the papers blown off it. The fan guard is very substantially made as well as the fan itself thus eliminating danger of accident due to mechanical weakness in connection with these two points.

Automatic Cord Adjuster

The Gowan Automatic Electric Cord Adjuster is a handy device which enables you to bring the full force of a lamp just where it is wanted. The device consists of a spring coil enclosed in the canopy base. By giving the cord a slight pull to release the catch, it will circle around the drum and may



The Gowan Cord Adjuster allows you to place your lamp exactly where you want it.

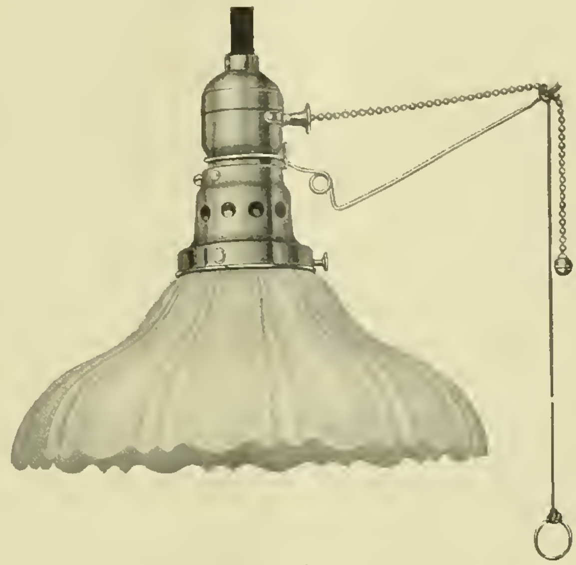
be adjusted to any desired length. A small rubber stop placed at the proper height rests against the canopy and holds the light in the desired position. It is usual to furnish about nine feet of cord with this device. This fixture is being handled by F. G. Forst & Company, manufacturers and patentees, 116 Church Street, Toronto.

100-Watt Nitrogen Lamp

The Edison Lamp Works of the General Electric Company, Harrison, N.J., have announced the production of a 100-watt nitrogen-filled lamp. The centre of the filament of the new lamp is the same distance from the base as in the old vacuum lamp so that the distribution of light when the new lamps are placed in existing reflectors will remain unchanged. The new lamp is claimed to give 20 per cent. more light than the tungsten vacuum lamp and to be a nearer approach to daylight. The efficiency is placed at .8 watts per candle with an average life of 1,000 hours.

Spring Attachment For Pull Socket

The Empire Engineering & Supply Company, 227 Fulton Street, New York, are placing on the market a spring attachment for pull sockets, as shown herewith. The spring in the attachment lifts the chain and takes the strain off the



socket. The attachment snaps on so that no screws are required. It fits any type of shade holder and can be adjusted to pull at any angle.

Under New Management

The Thordarson Electric Manufacturing Company, Chicago, have recently made an entire change of management. Mr. Nelson W. Dingwall, formerly general manager of the Chicago Drop Forge & Foundry Company is now general manager of this firm, and Mr. R. A. Connor has been made chief electrical engineer.

Change of Address

Fraser & Chalmers of Canada, Limited, announce that on account of the necessity for increased space, brought about by their rapidly growing business, on May 1st their head office will be transferred to 59 Beaver Hall Hill, Montreal.

Trade Inquiry

Name and address of inquirier may be obtained on application to the Electrical News, Toronto.

429. **Street car rails and wood paving blocks.**—An English municipality will be in the market in a few months' time for street car rails and wood paving blocks. Firms interested should quote per ton for 60-foot rails, stating the specification usually adopted. With regard to blocks, samples should be submitted. Sizes 3-inch and 4-inch wide by 4-inch and 5-inch deep by 7-inch to 9-inch long.

Trade Publications

Bruce Peebles & Company, Limited, engineers, Edinburgh, have just issued booklet No. 706B, describing with profuse illustrations Peebles' works and manufactures.

Wire Clamps—Folder issued by the Steel City Electric Company, Pittsburgh, Pa., describing Marchand clamps for stranded wire.

Enclosed Fuses—The Chelten Electric Company, Philadelphia, are distributing a new bulletin describing in detail their new enclosed fuses.

Current News and Notes

Brantford, Ont.

The Street Railway Commission of the city of Brantford have presented a report to council, covering the period from August 1st, 1914, to December 31st, 1914, which shows a gross revenue of $33,412 and a net of $7,905. This is sufficient to pay interest on the bonded debt, $2,693, interest on advances by the city, $2,666, and other expenses, with the exception of the 1914 installment of the principal due re pavement debt.

Cobalt, Ont.

It is reported that the mining camps in and around Cobalt have been seriously inconvenienced during the past month by a shortage of electric power.

Calgary, Alta.

A report comes from Calgary that an offer has been received from a United States syndicate to buy out the street railway system of that city, on condition that a reasonable franchise be given.

The annual report of the Public Utilities Commission of the city of Calgary for the year 1914 shows a net surplus for the year of $77,857.96 in the electric light and power department. The surplus in the street railway department is $3,831.60.

Durham, Ont.

The municipality of the town of Durham has completed arrangements with Mr. McIntyre, owner of the private electric light plant, to take over that system at a price that has been arranged.

Halifax, N.S.

The Mulgrave Power Company has been registered with capital $50,000 and head office in Mulgrave, N.S. The object of the company is to supply the town with electric power, light and water.

Kamloops, B.C.

Hydro-electric by-laws aggregating the sum of $85,000 were voted upon on April 6th, passing with a large majority. This money will be used for completing the hydro-electric system upon which half a million dollars has been expended. The city anticipates great results through their fine power plant, which it is expected will be in operation in the course of a few weeks.

Medicine Hat, Alta.

The Alberta Electric Company has made an assignment to the Trusts & Guarantee Company, Limited.

Moose Jaw, Sask.

The Acme Electric Company, Limited, has been incorporated in Moose Jaw, Sask.

Montreal, Que.

Messrs. Ovide Pepin and Sylva Normandin have registered as dealers in electrical supplies in Montreal, P.Q.

At a luncheon of the Montreal Jovian League, Mr. T. H. Nicholson, of the Bell Telephone Company, read a paper on "How to Dodge Trouble." The paper dealt with the means to avoid interruptions to the telephone service.

Mr. Lawford Grant, sales manager of the Eugene F. Phillips Electrical Works, Limited, Montreal, has returned from a long visit to England.

The Home Guard of the Montreal Light, Heat and Power Company now numbers about 120 members. The uniforms and rifles are supplied by the company.

The Cedars Rapids Manufacturing and Power Company have closed a contract for supplying 5,000 h.p. to the Northern Power Company, Massena, N.Y., the current being delivered over the transmission line of the Aluminum Company of America. The power is, in turn, to be delivered to customers of the power company within a radius of fifty miles from the central station. The Cedars Rapids company have now three large consumers, the Aluminum Company, Montreal Light, Heat and Power Company, and the Northern Power Company.

The Premier Electric Company, Limited, has been incorporated under federal charter; head office, Montreal; capital, $49,000.

Perdue, Sask.

The Perdue Telephone Company, Perdue, Sask., has been incorporated.

Peterborough, Ont.

An appeal has been entered on behalf of the city of Peterborough against the award of arbitrators in the matter of the price paid by the city to the Peterborough Light & Power Company, for the latter's plant, which was recently expropriated.

Regina, Sask.

The Street Railway Commissioners of the city of Regina Municipal System estimate a deficit of $102,000 for the year 1915 and urge that the citizens use the street car system much more freely.

The estimates of the electric light and power department expenditure for the year 1915 amount to some $318,000. A surplus of $15,000 is expected on the year's operation.

St. Johns, P.Q.

The St. Johns, P.Q., Electric Light Company, operated by the Southern Canada Power Company, have extended their line to Beloeil.

St.Laurent, P.Q.

Messrs. Hertel Joanette and Armand Gosselin have registered as electrical contractors in St. Laurent, P.Q.

Three Rivers, P.Q.

The City Council of Three Rivers, P.Q., have under consideration a scheme of re-lighting the principal streets. The scheme will probably include a number of lights on ornamental standards. All the preliminary work, such as taking levels, etc., has been completed prior to the Three Rivers Traction Company commencing the construction of the electric line for which they recently obtained a franchise.

Toronto, Ont.

Wm. Proudfoot, M.L.A. for Centre Huron, introduced an amendment to the Hydro-electric Power Commission Act, giving the municipalities the right to nominate one member of the provincial commission. The premier intimated that the government proposed to consider this matter at a later date and the amendment was not pressed.

The Ontario Railway and Municipal Board recently considered the application of the employees of the Toronto Railway Company to have the running board done away with. No radical change will be made this season, but the running board will be widened and a different type of hand rail installed.

The annual report of the Hydro-electric Power Commission of Ontario recently tabled in the legislature by Sir Adam Beck, chairman, states that in the 69 municipalities

which are using hydro power, an average total surplus of 10 per cent. is shown, after making all deductions for cost of service and depreciation. The assets of the system are now placed at fifteen and a quarter millions. The gross revenue for the year 1914 was $3,433,936, as against $2,617,439 in 1913. The surplus for the year is $401,349.

The Honorable Adam Beck, chairman of the Hydro-electric Power Commission of Ontario, which at the present time is actively engaged in working out a system of hydro radials for the province, was chiefly instrumental in having the franchises of a number of prospective electric railway companies cancelled, when application was made for extension of time in which work on these be commenced. It was argued that work on these railways was being unduly delayed and that, as the route of certain of them more or less paralleled that proposed by the commission, for its own system, the construction of a railway by a private company might interfere materially with the success of the hydro radial system.

By an amendment to the Hydro-electric Power Commission Act, municipalities of over one hundred thousand population are now permitted to adopt the commission system of government by which the council and Provincial Commission each appoint a commissioner, with the mayor of the city as the third member.

The Toronto & York Radial Railway Company have withdrawn their application to double track the lower end of their system on Yonge Street, which they recently made to the Ontario Legislature.

The Humber Valley Electric Railway Company have been granted an extension of time within which they may commence and complete the construction of their railway. A proviso is added, however, that the city of Toronto or the Hydro-electric Power Commission of Ontario may take over this road after five years, if they find it in the interests of a larger scheme of radials surrounding the city to do so.

An Act has been ratified in the Ontario House vesting the Hydro-electric Power Commission of Ontario with full powers regarding the appointment of wiring inspectors throughout the province. It is understood that certain controversies have arisen between the municipalities and the Commission regarding the personnel of these appointments in the past. It is hoped that the present act will expedite matters and allow the Commission to work out its scheme of universal inspection through the appointment of competent inspectors without unnecessary delay.

Vancouver, B.C.

At a recent meeting of the Burnaby council, Councillor Ward suggested that a report be obtained on the feasibility of erecting a hydro-electric plant on Brunette River, capable of supplying the municipality with light and power.

Woodstock, N.B.

The Board of Commissioners of Public Utilities of New Brunswick have granted the application of the Woodstock Electric Railway, Light and Power Company for an order authorizing them to charge their consumers of electric light for lighting purposes within the town of Woodstock a minimum of 75 cents per month exclusive of meter charges.

Winnipeg, Man.

The Bentz-Richardson Company, Limited, of Winnipeg, have moved their headquarters from 114 Phoenix Block to 150 Princess Street. Taking effect April 1, Mr. A. E. Esling has been elected vice-president. Mr. Richardson, secretary-treasurer of the firm, is leaving Winnipeg on April 15th for Kansas City, from which point he will proceed to Boston, Mass., where he will be engaged in the electrical trade.

Condensed Department

Publisher's Notice

Advertisements under "Situation Wanted" "Situation Vacant" or Miscellaneous, are charged at two cents a word per insertion, minimum charge 50 cents.

Advertisements for tenders, equipment, wanted or for sale, etc., are charged at $2.10 per inch.

All advertisements must be in the publisher's hands by the 10th or 23rd of the month to insure insertion in the subsequent issue.

POSITIONS WANTED

Graduate electrical engineer, age 29, with factory, test and engineering office experience, and some sales experience, desires position as sales engineer with line company. Box 179, Electrical News, Toronto. S-S

Agencies Wanted

Wanted—Agencies from progressive manufacturers for saleable electrical and allied hardware lines; others don't apply. Can handle your goods to best advantage, having offices in Winnipeg, Regina and Edmonton. Don't procrastinate. Make your arrangements now with Houston & Company, Limited, P. O. Box 773, Winnipeg. S-11

SITUATION WANTED

Permanent situation wanted as electrical foreman or power house superintendent. Eight years' experience in all the electrical lines and four previous years' experience with steam engineering. Box 171, Electrical News, Toronto. 7-8

FOR SALE

One G. E. 230 volt, 60 cycle rectifier for charging electric pleasure vehicle, used only a few months. Two hundred and ten dollars.

GEORGE J. BEATTIE,
72 Victoria Street, Toronto.

F

Lighting Schedule for May, 1915

Courtesy of the National Carbon Company, Cleveland

Date	Light	Date	Extinguish	No. of Hours
Apr. 1	7 20	Apr. 1	11 10	4 20
2	7 20	3	0 50	5 50
3	7 30	4	1 40	6 10
4	7 30	5	2 20	6 50
5	7 30	6	2 50	7 20
6	7 30	7	3 10	7 40
7	7 30	8	3 40	8 10
8	7 30	9	4 00	8 30
9	7 30	10	4 00	8 30
10	7 30	11	4 00	8 30
11	7 30	12	4 00	8 30
12	7 30	13	4 00	8 30
13	7 40	14	4 00	8 20
14	7 40	15	4 00	8 20
15	7 40	16	4 00	8 20
16	7 40	17	4 00	8 20
17	7 40	18	4 00	8 20
18	7 40	19	4 00	8 20
19	7 40	20	4 00	8 20
20	7 40	21	3 50	8 10
21	11 20	22	3 50	4 30
22	11 40	23	3 50	4 10
24	0 10	24	3 50	3 40
25	0 30	25	3 50	3 20
26	1 00	26	3 50	2 50
27	1 30	27	3 50	2 20
28	No Light	28	No Light	
29	7 50	29	10 30	2 40
30	7 50	30	11 30	3 40
31	7 50	Jun 1	0 20	4 30

Total Hours.......... 186.40

Electrical News
Generation, Transmission and Application of Electricity

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THOMAS S. YOUNG, General Manager.

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ADVERTISEMENTS

Orders for advertising should reach the office of publication not later than the 5th and 20th of the month. Changes in advertisements will be made whenever desired, without cost to the advertiser.

SUBSCRIBERS

The "Electrical News" will be mailed to subscribers in Canada and Great Britain, post free, for $2.00 per annum. United States and foreign, $2.50. Remit by currency, registered letter, or postal order payable to Hugh C. MacLean, Limited.

Subscribers are requested to promptly notify the publishers of failure or delay in delivery of paper.

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Vol. 24 Toronto, May 1, 1915 No. 9

A Use for Our Water Powers

A timely subject in these days of urgent need of unlimited quantities of high explosives, is the fixation of atmospheric nitrogen. The commercial forms in which nitrogen is available are chiefly, (1) nitrates, (2) cyanides, and (3) ammonia. Nitrates have been chiefly obtained from Chile, where the supply has been considered inexhaustible. The recent annual output, however, has approximated two and a half million tons of this chemical, and it begins to appear that the end of the supply might be in sight. The annual value of this product is enormous, at the present ruling price of twenty-five to forty dollars a ton f.o.b. Chile. Cyanides have been manufactured in the recent past chiefly in England and Germany, which countries have exported at the rate of 20,000 tons per annum. The price of this product is anywhere from $300 to $400 a ton. Ammonia in the form of the sulphate has at the present time a market for approximately a million and a quarter tons at a price varying from $40 to $60. It will thus be seen that the nitrogen chemical industry involves annually approximately a $200,000,000 outlay.

The fixation of atmospheric nitrogen by the use of electricity has been the dream of electrical chemists for many years, and much experimental work has been done and considerable money spent in endeavoring to perfect a scheme of manufacture which would be economically possible. It is this side of the question that should appeal to Canadians. Nitrogen is a commodity in connection with which one does not have to consider the location of the factory. It would seem possible, therefore, that some of our large water falls, devoted to the production of electricity, could be utilized for fixing atmospheric nitrogen long before their isolated location would make these powers useful for any other purpose. The only question would appear to be the shipping of the finished product.

An article printed elsewhere in this issue covers the question of the reclaiming of atmospheric nitrogen very fully. This article, presented before the American Institute of Electrical Engineers, will be continued in our next issue and the latter part will deal particularly with a description of the electrical processes that have been most successfully tried out up to the present time. One cannot read this article without being convinced that right here is an almost certain field in the near future for Canadian water powers at present going to waste, when, in a short time, the scale of economic production shall have turned in favor of electricity. Looking over the developments of the past few years, one cannot doubt that the near future will see another triumph of this form of energy.

Why the Delay?

The Hydro-electric Power Commission of Ontario are warning contractors, wiremen and central stations by advertisements throughout the province, that the rules and regulations of the Commission must be carefully observed. They are again pointing out some of the most important of these rules and are referring interested parties to the electrical inspectors in their particular localities for further information, licenses, approval certificates, and so on.

This raises again that very interesting question of how contractors, wiremen and central stations in and in the vicinity of such centres as Galt, Preston, Peterborough, and so on, can make application to an officer who does not exist. No doubt interested parties in these towns are perfectly willing to abide by the rules and regulations of the Commission to obtain licenses for the carrying on of their work and fulfil in every way the requirements of the Commission, if they were only given a chance; but it appears incomprehensible that the Commission should have established a set of rules and regulations some two or three years ago, should have insisted in certain towns and cities that these rules and regulations be observed, should advertise widely all over the province that these rules and regulations must be universally observed and yet at certain points do not supply any machinery for carrying out their various mandates. It surely cannot be that the reason inspectors have been appointed at certain centres is because contractors, wiremen and central stations in those vicinities are less law-abiding than the same class of people operating in such towns as Galt, Preston and Peterborough. Neither does there seem to be a dearth of suitable applicants. The machinery of the Commission seems to operate unaccountably slowly in these matters.

Quite aside, too, from the anomalous position the Commission places itself in by such delay in the appointment of inspectors, they are doubtless accumulating a considerable amount of trouble for themselves later in the way of work which will have to be remedied or entirely replaced. At many points in Ontario where inspectors have not been named, a considerable amount of electrical work is going forward. This, generally speaking, will not conform accurately with the requirements of the Commission. Yet the Commission, by their omissions, are tacitly approving work not installed according to their rules and regulations. If these rules are necessary in Hamilton and Guelph, they are necessary in Galt and Peterborough. If the lives of the citizens require it in one city, they also require it in another. Either the appointment of inspectors in these towns and cities where they have been already appointed was unneces-

sary and the expense involved was unjustifiable, or the Commission is lax in not appointing inspectors in Galt and Peterborough and other towns. Having published these rules and regulations, the Commission have publicly declared the need of them. Should a fatal accident occur through delay in administration, it is difficult to see how the Commission could be described otherwise than as "criminally negligent."

"Electrical Prosperity" Week

A campaign is on in the United States to boost for an "electrical prosperity week," and an electrical prosperity week committee has been appointed and certain details in connection with the campaign have already been determined. This committee is co-operating closely with the Society for Electrical Development, and the Society has decided to spend a large sum of money between now and the special date set, on advertising "electrical prosperity week" as fully as possible. This society will handle the details of the affair, though leading electrical manufacturers and jobbers will also spend large sums of their own money in publicity for their own particular products. At the last meeting of the committee, the date definitely fixed was the week between Monday, November 29th and Saturday, December 4th, 1915. This will furnish an impetus for an early shopping campaign for Christmas electrical goods and will give merchants a chance to begin their extra display and illuminations earlier and continue them without a break until Christmas. It is believed that the after-effects of this week's effort will be of great benefit to the central stations and the dealers.

This movement might well be extended to Canadian territory during the same period, as undoubtedly we would gain by the publicity campaign in the United States, while they would gain by the addition of Canada's large buying capacity.

Standardizing Line Construction

The sixth meeting of the National Joint Committee on Overhead and Underground Line Construction was held on Wednesday, March 31st, from 10.30 a.m. to 5.00 p.m., in the rooms of the American Institute of Electrical Engineers, New York City. The committee devoted most of its time at this meeting to discussing the various clauses of the overhead power wire crossing specifications, and the work of revision was gotten well under way. The specification was divided into four sections and sub-committees appointed to handle the work of revision on their respective sections. Circular letters have been issued to operating companies, tower manufacturers, consulting engineers, and others, requesting that they furnish the committee with data, reply to a series of questions, and forward opinions regarding the proposed specifications. What the committee particularly desires at this time is the suggestion of specific clauses, or paragraphs, to be added to or changed in the existing specification, and it is hoped that anyone interested in this subject will communicate at once with the committee.

Saving in Current Consumption

The Annapolis Short Line Company, operating thirteen cars between Baltimore and Annapolis, on January 1st, 1915, equipped their motor cars with ampere hour meters, so as to check up the current consumption of the various motormen. During the month of January the men were instructed in the art of coasting, etc., and, as a result, the February records show a saving of 23 per cent., as compared with the current consumption of February a year ago, the amount being 4.2 kw.h. per car-mile this year, and 4.7 kw.h. per car-mile in 1914. The March figures are even better, being 3.4 kw.h. per car mile, as against 4.5 a year ago, a saving of 24 per cent.

New Plant for Hamilton Incline

Steam Replaced by Electric Drive and Control—Storage Battery for Possible Emergencies and for Peak Loads

The electric hoist recently installed by the Hamilton Mountain Park Company, Limited, to operate its incline railway is notable on account of its size and also of the ingenious automatic safety devices with which it is equipped. The difference in elevation between the general level of the city and that of the plateau stretching away from the top of the mountain is about 325 ft. Originally a steam hoist was used to give easy communication between this plateau and the city and, as the roads along the side of the bluff are few and steep, the incline railway did a large business in transporting wagons, automobiles, and passengers. But this system became inadequate for the demands on it and the company of which Mr. George F. Webb is president, gave to the Canadian General Electric Company a contract to design and erect an electric hoist capable of taking proper care of the rapidly increasing traffic.

Electrical Equipment

Power is supplied in the form of 3-phase, 25-cycle, alternating current, and for transforming this to direct current a motor generator set has been installed of sufficient capacity to supply the average demand of the hoist, plus some surplus for charging the battery described below. The direct current end of this machine is rated at 165 amperes continuously at 550 volts, the latter being the floating voltage of the battery. This generator is driven by a 2,200-volt induction motor. The generator end is designed with a special drooping characteristic by means of a reversed series field for the purpose of throwing load fluctuations on the battery. A small percentage of the load fluctuations falling on the machine will lower its voltage to such an extent that the battery must discharge and furnish the balance of the momentary demand. The regulation is, therefore, inherent in the design of the machine, and is entirely automatic.

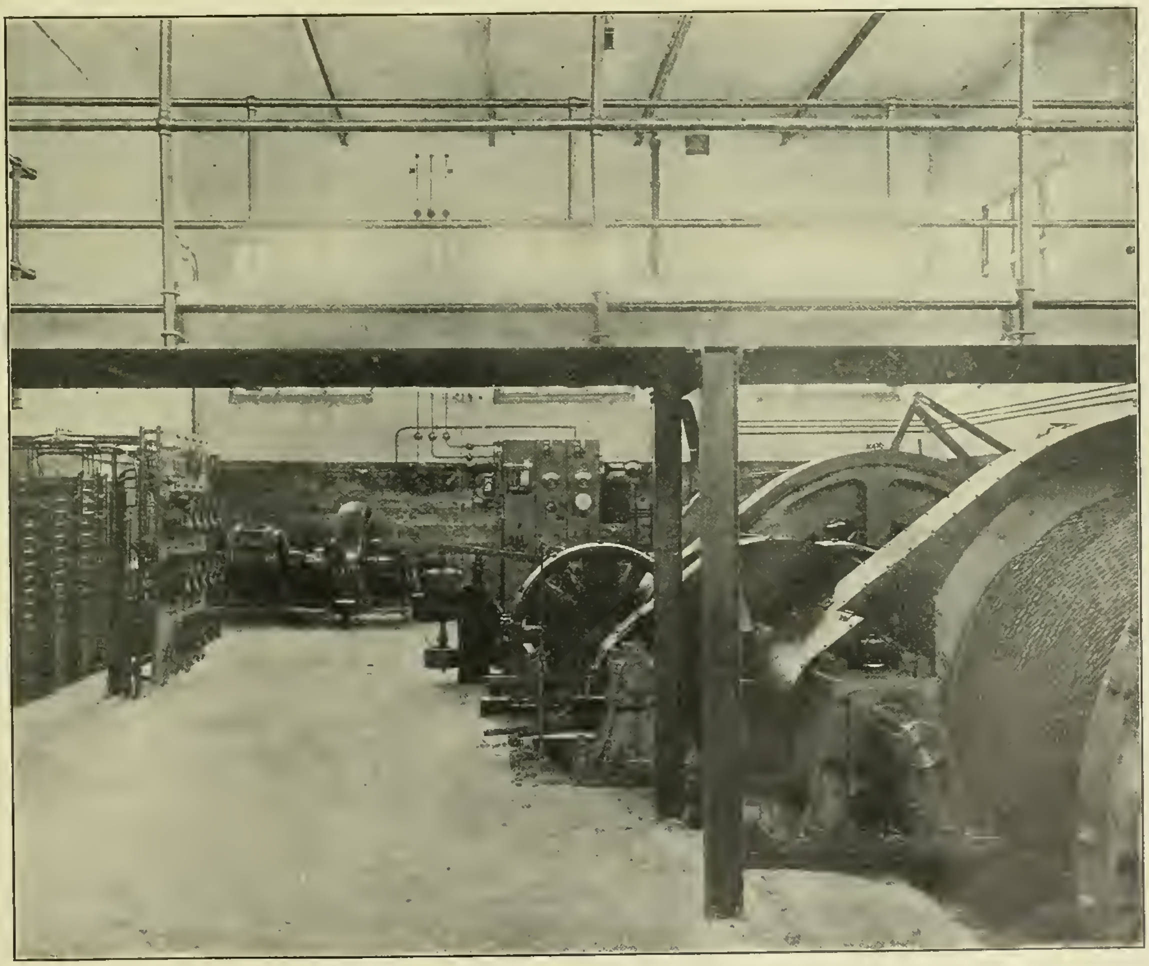
The hoist is driven through two-gear reductions, the total ratio of which is 29.84 to 1 by a 180 h.p., 500 volt—475/585 r.p.m. direct current motor which is specially designed to stand such voltage variations as come from a storage battery when it is frequently charging and discharging. The motor is controlled by a magnetic contactor panel so that it is convenient to control the motor remotely from the operator's station. This system of control admits of the various protective devices already described to ensure against the cage operating at greater than a pre-determined speed. To ensure a greater degree of continuity of service a reserve 180 h.p. motor and solenoid brake are provided. The machinery of the hoist is so constructed that in a very few moments time one motor can be disconnected from the hoist and the other clutched in ready for service. The master controller is situated in the operator's cabin at the top of the incline.

Storage Battery

The power plant has been supplemented by a storage battery built by the Electric Storage Battery Company, of Philadelphia. One of the objects of installing this battery was to reduce the maximum peaks due to the fluctuating load of the hoist, and thus reduce the power bills. Another object was to furnish current for operating the hoist if alternating current supply is interrupted.

The demand of the hoist motor when lifting a load of 7½ tons was estimated at 470 amperes for ten seconds followed by a demand varying from 410 down to 230 amperes for a period of 80 seconds, the voltage being approximately 550 volts. Under the conditions of maximum schedule it was estimated that the load period of 90 seconds, mentioned above, would be followed by a 3-minute rest, thus providing for a trip of the hoist every 4½ minutes. For handling a 10-ton

Incline Railway—Hamilton Mountain Park Co.



Hamilton Mountain Park Co.- General view of incline railway power house.

load, the maximum ten-second demand was estimated at 530 amperes followed by 80 seconds of load varying from 470 down to 310 amperes. The hoist is designed to handle a 15-ton load occasionally, but this will not occur when the battery is handling the entire load with the power supply cut off. It is believed that hoisting a 7½-ton load every 4½ minutes will represent the average conditions during the hours of maximum traffic. The average load is 112 amperes on this basis.

The battery consists of 262 cells of the Tudor Box type. Each cell contains 11 plates, type F, measuring approximately 11 ins. by 10½ ins., five of the plates being positive of the Tudor type and six of the plates being negative of the Box type. The plates are supported in glass jars mounted on glass sand trays, the entire battery being installed on wooden racks. The capacity of this battery is 200 amperes for one hour on continuous discharge. For intermittent service extending over several hours the ampere hour capacity will be somewhat greater and it is estimated that this battery will operate the hoist under the average load conditions cited above over 1¾ hours with the power supply entirely cut off; or if the schedule is reduced, so that the trips of the hoist are made less frequently, the hoist can probably be kept in operation for several hours.

Under normal conditions with the motor generator supplying the average load, the battery does not become exhausted but receives back sufficient charge during the period of rest between trips to make up for the discharge while the hoist is in operation. The battery, therefore, while relieving the motor-generator and power line of the severe load fluctuations is maintained at all times practically full and ready to supply the entire demand in case of interruption to the power supply.

Electric Hoist

A special double fixed drum double geared electric incline hoist built by the Lidgerwood Manufacturing Company, of New York, operates two cars in balance on an incline 800 ft. long with a grade of 40.27 per cent. Each car weighs 30,000 lbs. and runs on tracks having a gauge of 12 ft. 1½ ins., the centre to centre of tracks being 20 ft. 3 ins. The average load on the cars will be about 20,000 lbs. with a maximum load of 30,000 lbs. and the hoist arrangement is suitable for either hoisting the maximum load with empty car descending, or for lowering the maximum load with the empty car ascending.

The time required for making a single trip is 1½ minutes, and the rest period between trips 3 minutes. Attached to each car are two ropes of 1⅝ ins. diameter, each rope weighing 4.15 lbs. per ft. One of these ropes is used for hauling the car, and the other for the purpose of safety. The average rope speed during the run is 585 feet per minute.

Incline Arrangement

The hoist is located in a house 106 ft. from the knuckle between the incline and the level of the summit. The main rope from the right hand car is wound over the top of the right hand hoist drum. The main rope from the left hand car is wound underneath the left hand hoist drum. The safety rope from the right hand car is led over suitable deflecting sheaves to the top of the left hand drum, and the safety rope from the left hand car is wound over suitable deflecting sheaves to the bottom of the right hand drum. Each of these sheaves is 7 ft. diameter to the bottom of the rope groove and weighs 3,500 lbs. There are 4 head sheaves and 4 deflecting sheaves, making 8 in all. The head sheaves are arranged vertically so as to carry the hoist ropes and safety ropes in a direct line from the cars, the deflecting sheaves are placed horizontally at such an angle that the rope will be led in a direct line to either the top or bottom of the hoist drums, as the case may be. Floating sheaves are also furnished to guide the ropes and are placed in the rope tunnels between the head sheaves and the hoist drums. The reason for reeving the safety ropes as outlined above is that in case of an accident to the left hand side of the hoist the safety rope on the left hand car would take care of it properly being wound on the right hand drum; the same thing would apply if the other drum of the hoist should become disabled, that is, the main ropes and the safety ropes from each car lead to opposite drums. Further advantage is gained by the fact that each drum is equipped with an independent double acting brake, and in case either of the main ropes should break, the safety rope will hold the cars. Furthermore, the safety rope if called upon to take the load will be controlled by all the automatic brake features in exactly the same manner as when the load is being handled by the main ropes. In actual operation the length of the safety ropes will be slightly more than that of the main hoist ropes, thereby relieving the safety ropes of any hoist stresses other than those required to keep the ropes themselves in motion.

Operation and Safety Appliances

The operator's cabin is fitted with one electric control and two hand brake levers. The levers will not be used ordinarily as the hoist is equipped with solenoid brakes operating on the motor shaft. The hand brakes, therefore, need only be used for the locking of the cars at the top and bottom positions or for cases of emergency. In starting a run the operator releases the drum post brakes by the hand levers, puts his foot on the small foot pedal located at bottom of master controller and by moving the handle of the controller to either the right or the left, as the case may be, the cars will start and will automatically accelerate to the normal rope speed. At a predetermined point on the incline, the controller handle will be automatically turned to such a position that the speed will be cut down to 1/10 of the normal and finally be turned to the off position, thus setting the solenoid brakes and bringing the cars to rest. Should the operator become disabled during a run, he will of necessity remove his foot from the foot pedal thereby cutting off the current, bringing the cars to rest. Before the cars can move, the operator's foot must be on this pedal. In case the cars should stop short of their landing positions due to the automatic overwinding mechanism, there are available two or three points on the controller so that the operator can bring them to their proper positions. Should the cars fail to stop due to the fault of controller, an overwinding device is attached which will shut off the current and set the solenoid brakes. Should the speed of the cars exceed the normal by a predetermined amount an overspeeding device is so arranged that it will trip a weight of 570 lbs. which will set the drum post brakes. This overspeeding device or governor is of the fly ball type, and it will be caused to operate by an excessive speed, whether due to motor or a breakage of the hoist parts. The emergency weight may also be tripped manually from the cabin.

Shafts and Drums

The drum shaft is a steel forging made in two pieces, 12 ins. diameter. Including the two sections it is 32 ft. long, and weighs 13,300 lbs. The intermediate shaft has been machined from a single steel forging and is 7 ins. diameter its entire length. It is 20 ft. long, and weighs about 3,000 lbs.

There are two cast iron drums 96 ins. diameter, 70 ins. face, and coil 800 ft. of 1⅝-in. rope, plus 3 holding coils at each end on one layer. These drums are made up in 2 sections, of barrel construction and are bolted at one end to the post brake ring, and at the other end to the drum gear. The two sections composing each drum weigh each 8,350 lbs., which means a total weight of drum barrel for each drum 16,700 lbs. Each of the drum gears is made of cast steel with cut involute teeth, and is of the double arm wheel type having eight arms reinforced by ribs forming an "H" section. The gear has 122 teeth of 1 D.P. and a face 12 ins. in width, the pitch diameter being 122 ins.

Fixation of Atmospheric Nitrogen

Commercial Compounds of this Element, their Consumption, Value and Source—A big Opening for Electricity.

By Leland L. Summers*

In 1898 Sir William Crooks in his address as President of the British Association, very forcibly pointed out that the commercial fixation of atmospheric nitrogen was one of the greatest discoveries awaiting the ingenuity of chemists. He emphasized with very interesting figures its important practical bearing on the future welfare and happiness of the civilized races. This address brought forcibly to the attention of engineers the fact that the existing sources of fixed nitrogen were limited, and greatly stimulated the efforts of investigators. The problem itself had been worked on for over a century as it was known that nature fixed nitrogen of the atmosphere by means of electric discharges, and Cavendish in 1781 had shown that a small amount of nitrogen was converted into nitric acid in the combustion of hydrogen with oxygen to form water, while Bunsen in 1877 obtained favorable yields by means of gaseous explosions. The earlier efforts commercially in the art were however largely confined to the fixation of nitrogen for the purpose of manufacturing cyanides, and the earlier bibliography of the subject therefore deals almost entirely with these efforts.

Commercial Products of Nitrogen

The three fundamental commercial products formed by nitrogen are first, its union with oxygen to form nitrates NO_3 and nitrites NO_2. Second, its union with carbon to form cyanogen C_2N_2 and producing cyanides XCN and cyanamides XCN_2. Third, its union with hydrogen to form ammonia, NH_3. From all of the above products there are obtained a large number of derivatives used in the chemical arts.

Nitrates.—The most important of all commercial products are the unions of nitrogen with oxygen forming the nitric acid salts of commerce. These are of particular importance on account of the vast natural deposits of nitrate of sodium ($NaNO_3$) occurring in Peru and Chile, commonly called Chile saltpeter. Practically, this commodity is the one that sets the price for all other compounds of nitrogen, as it has been mined in Chile since 1830, and during the past 25 years its production has assumed vast proportions, the present annual output amounting to about 2,500,000 tons. This deposit of Chile appeared inexhaustible and therefore there was no occasion for alarm regarding the world's supply of combined nitrogen, but after years spent in exploration work it began to appear that the Chilean deposits would be exhausted before the end of the present century, and since then all other sources of combined nitrogen have received attention.

While there are a few scattered natural deposits other than those in Chile, there is none which has at the present time a chance of competing, most of them being of limited extent and situated in inaccessible regions. In Chile the deposits are easily worked and even after years of careless mining with no effort to effect economies, the present cost of producing nitrate is not excessive, varying from $10 to $20 per ton and selling in Liverpool for about $45 per ton. This leaves a profit of from $5 to $10 a ton on the operation after paying the Government of Chile an export tax of about $12.25 per ton. In the past 30 years this export tax has netted the Chilean Government about $500,000,000. Of the total production of Chile the United States imports about 600,000 to 700,000 tons per annum the balance being practically all shipped to European countries. Chile saltpeter has sold as high as $60 a ton but since 1909 when the agreement among the producers expired the price has approximated $45 per ton f.o.b. Liverpool, making a price of from $35 to $40 per ton f.o.b. Chile.

* Before the A. I. E. E.

Cyanides.—The union of nitrogen and carbon to form cyanides and with hydrogen to form ammonia are two of the earliest forms in which the combined nitrogen was utilized. Most all animal and vegetable refuse contains ammonia compounds and these were the early sources of ammonia, and animal refuse products such as hides, hoofs and horns were the sources of combined carbon products forming the cyanides. Until the discovery of the McArthur-Forrest process for gold extraction, the markets for cyanides were comparatively limited and there was no great effort made to produce them on a large scale. With the rapid development of this art in the recovery of the low grade gold deposits a sudden impetus was given to the cyanide industry, and large quantities of cyanides are now manufactured from ammonia and metallic sodium. Small amounts of cyanides for industrial purposes are recovered from the gas retort houses but these processes are not generally applied and no particular effort has been made to extend the processes to the recovery of cyanides from by-product coke ovens. The greater portion of the cyanides are manufactured in England and Germany and some 20,000 tons per annum are exported annually by these two countries. As the cyanides of sodium and potassium for gold recovery purposes sell from $300 to $400 per ton, they represent one of the highest prices of nitrogen directly combined with a simple element.

Ammonia.—The third great commodity of commerce, ammonia, is utilized extensively in industrial arts but in addition has been used for many years as a fertilizer. The annual production of sulphate of ammonia $(NH_4)_2SO_4$ now amounts to about 1,250,000 tons and the Liverpool price approximates that of sodium nitrate, varying from $45 to $60 per ton. Practically all of this sulphate of ammonia is manufactured from coal distillation either from gas house retorts or by-product coke ovens, up to the past year there having been practically no process in operation for the direct synthesis of ammonia from its compounds.

All the older retort processes for the manufacture of gas, recover ammonia by washing the illuminating gas with water. All by-product coke ovens likewise treat the by-product gas for the recovery of ammonia. American coals run from 0.9 per cent. to 1.4 per cent. nitrogen or from 18 to 28 lb. of nitrogen per ton of coal. In the distillation of this coal about 20 per cent. of the nitrogen is recovered from the gases of distillation so that from 4½ to 7 lb. of ammonia are recovered per ton of coal distilled; this ammonia when united with sulphuric acid forms sulphate of ammonia, giving a yield of from 18 to 28 lb. of sulphate of ammonia per ton of coal distilled. Weak solutions of ammonia water are concentrated from the gas house retort and the ammonia distilled from this water by breaking down the ammonia contents with lime, the pure ammonia then being united with sulphuric acid. In many of the coke oven plants the sulphate is formed directly by passing the gases into sulphuric acid forming the ammonia sulphate by a direct process.

In general it costs about $15 per ton of ammonia sulphate to manufacture the sulphate from the ammonia, so that if ammonia sulphate is selling for $45 per ton, $15 of this is represented in the cost of sulphuric acid and the manufacturing, making the net ammonia cost with profit $30 per ton of sulphate or as the nitrogen content of the sulphate amounts to 21 per cent., the nitrogen represents an actual value of 7 cents per pound. With the great increase in the number of by-product coke ovens, there has been a greatly increased quantity of ammonia sulphate manufactured, and it would seem that under these conditions the price of ammonia sulphate will tend to diminish rather than to increase. The actual cost to the by-product coke oven plants recovering the ammonia, in addition to the $15 for

manufacturing the sulphate of ammonia, will approximate $10 per ton, and if there is any profit to be obtained from the sale of ammonia, they can afford to recover it at this figure.

Another source of ammonia by coal distillation is from producer gas generated on what is known as the Mond system. In this process steam is admitted to the producer in excess, so that the temperature is not permitted to rise to a point where the ammonia liberated by the fuel is decomposed. This excess of steam tends to protect the ammonia and it is recovered from the producer gas by washing. In this process not only the ammonia carried in the volatile products is recovered but also a large percentage which ordinarily remains in the carbonaceous residue of the coke oven and gas house retort. As ordinarily distilled about 50 per cent. of the total ammonia of the coal remains in the coke residue and is not recovered. In the producer where this coke is consumed in the presence of steam the total percentage of recovery may be as high as 75 per cent. of the theoretical nitrogen contained in the coal, so that from 15 to 20 lb. of nitrogen may be recovered, or in terms of ammonia sulphate, from 60 to 80 lb. of ammonia sulphate may be obtained per ton of coal consumed in the producer. This type of producer has not been extensively utilized in America as the expense of installation is increased by the necessity of washing a very large volume of low grade gas, the volume of gas per ton of coal consumed in the producer being about 130,000 cu. ft. against about 10,000 cu. ft. per ton of coal as distilled in the coke oven.

A number of these plants have been installed in England and on the continent, but the aggregate of the ammonia sulphate produced is not large as compared to that from coke ovens and gas house retorts.

Available Nitrogen in Commercial Products

The question of the available nitrogen in the various compounds has in a measure determined the price of the product, the utilization in the fertilizer art being practically the basis of fixing the price. For a number of years it has been assumed that the selling price of combined nitrogen would be from 12 cents to 13 cents a pound. Thus Chile saltpeter being about 95 per cent. pure nitrate of soda would have a theoretical nitrogen content of about 16.5 per cent. or corrected for impurities would have about 15.5 per cent. nitrogen.

As the cyanides until recently were not used directly in the fertilizer art and were combined with more expensive products, their price has not been regulated by their content of combined nitrogen. The ammonia used in the fertilizer art is almost entirely used as sulphate of ammonia, on account of the cheapness of the commercial sulphuric acid and the ease of manufacture, and this product would therefore have a theoretical content of 21 per cent. of nitrogen.

The above nitrogen products may be considered the fundamental commercial forms in which combined nitrogen enters the market, and while the fertilizer industry fixes the price of combined nitrogen, it is only one of the many industries in which vast quantities of nitrogen are utilized. Thus about 50 per cent. of all the Chile saltpeter imported in this country is used in the manufacture of explosives, while an additional 25 per cent. is utilized in the arts requiring nitric acid. Of the ammonia sulphate, a very large percentage is used directly as fertilizer, though there is a very considerable demand for use in chemical industries and such commercial applications as anhydrous and aqueous ammonia used in the refrigeration art. Practically all explosives have utilized nitrogen compounds as a principal ingredient. The earlier black gun powder having used Chile saltpeter, charcoal and sulphur and the later so-called smokeless powder utilizes the oxygen carrying property of nitrogen as well as the inherent molecular energy in the production of such high explosives as nitroglycerin, cordite, lydite, mellenite, gun cotton and various other nitro-cellulose compounds, and modified explosives used in industrial work, such as dynamite and various blasting powders.

Fixation Processes

In considering the fixation of atmospheric nitrogen from a commercial standpoint, the limitations will be imposed by the selling price of the natural product from Chile, covering nitrate compounds, and the selling price of ammonia sulphate as obtained from coal distillation, affected as these prices will be by the manufacture of ammonia from atmospheric nitrogen.

In competition with the above sources of nitrogen there has been the constant effort toward the fixation or rather the utilization of some of the vast quantity of atmospheric nitrogen surrounding us.

A list of these fixation processes would contain the names of hundreds of investigators, and from the past twenty years of effort there may develop processes which at present are still experimental; but of the various processes which have reached the state of commercial application there appear to be four distinct lines of development.

First.—The production of nitric acid directly from the atmosphere by means of the electric arc. In this process the nitrogen of the atmosphere is directly combined with its accompanying oxygen without utilizing any other chemical substances, the process consisting essentially of a powerful arc furnace through which air is forced, causing at this high temperature the nitrogen to combine with the oxygen forming nitric oxide, NO.

Second.—Methods of fixing nitrogen by means of electric furnaces or combustion where the energy of chemical combination is utilized causing the nitrogen to combine with some substance with which there is a pronounced energy of chemical combination. These processes include furnaces utilizing calcium carbide with which nitrogen readily combines to form calcium cyanamide $CaCN_2$, and various processes for making combinations of nitrogen and a basic or alkaline earth metal such as calcium nitride, Ca_3N_2, or magnesium nitride, MG_3N_2, or aluminum nitride, AlN, the chemical action usually forming a nitride or carbo-nitride.

Third.—Processes for producing ammonia, NH_3, directly from nitrogen and hydrogen. These include the effort to use the various forms of electric discharge by which the nitrogen molecule may be decomposed and in the presence of hydrogen, form ammonia. As ammonia decomposes at a very low temperature (500 to 1,000 deg. C.) only the silent discharge seems available, and the yields are not commercial. The most promising of all direct ammonia processes seems to be that of Haber. In this process, a catalytic agent is used and under a heavy pressure the nitrogen molecule is decomposed and united to the hydrogen thus forming ammonia. Salts of uranium seem to be preferred as the catalytic agent and have the power of acting on nitrogen at a temperature of about 500 deg. C.

Fourth.—Production of a high temperature by combustion utilizing either catalytic agents or simply by producing a high temperature by means of the explosion or combustion of gases directly combining the nitrogen and oxygen to form nitric oxide, NO. This method early used by Bunsen in the combustion of hydrogen to form water has been applied to coke oven gases by Hausser. A bomb is used and the mixture of gas and air is fixed electrically, the small amount of NO formed is recovered and converted into nitric acid, HNO_3.

The chemical form in which the commercial supplies of combined nitrogen appear on the market is due largely to existing commercial conditions. The nitric acid combined as sodium nitrate occurs in this form simply on account of being naturally produced in this form. The ammonia appears on the market as ammonia sulphate largely on account

of the cheapness with which sulphuric acid can be obtained, and the widely distributed plants for its manufacture, making it one of the cheapest and most convenient forms of combining with ammonia. It is probable that in commercial nitrogen fixing plants, if both ammonia and nitric acid are manufactured, one of the most convenient forms for marketing this product will be by using nitric acid in place of sulphuric acid making ammonia nitrate, NH_4NO_3. This product is on the market at present but is only manufactured from sodium nitrate and from ammonia, or in some of the plants where nitric acid is manufactured, ammonia is shipped to the nitric acid plants to be manufactured into ammonia nitrate. The advantage of ammonia nitrate is that it has a nitrogen content of 35 per cent. in this respect being a much more concentrated nitrogen product either for the processes of manufacturing other compounds of nitrogen or for use in the fertilizer industry.

Physical Limitations and Those Fixed by Natural Sources

The competition with natural sources will fix the commercial limitations or selling prices for these various nitrogen compounds and in considering the possible developments of the processes it will be interesting to see to what extent they have definite theoretical limitations, as these will greatly affect any comparison of possibilities. Before considering in detail these processes we might endeavor to investigate whether our present conception of the physical and chemical reactions involved impose real limitations, or whether there is an uncertain boundary which further developments may encroach upon, perhaps thus continually improving the efficiency and possibilities commercially. If, for instance, the nitric oxide processes which utilize only 2 per cent. to 4 per cent. of the energy supplied to the furnace are limited to this amount by the inefficiency of the apparatus, there are much greater possibilities of development than would be the case if the process has definite physical or thermodynamic limitations, and the present apparatus utilizes a favorable percentage of this possible ultimate limit. To some extent these theoretical limitations are not always sharply defined, and research will extend this horizon, but we may determine some of these limitations quite definitely.

Theoretical Limitations

As we are considering this subject from its engineering aspects, it may be excusable to examine some of the theoretical limitations imposed by the laws of physical chemistry, and in reviewing what may be termed elementary formula, it is interesting to note that the investigation of these theoretical limitations has been of fundamental importance to physical chemistry in extending the application of the laws of chemical dynamics.

Molecular Inertness of Nitrogen

The elements carbon, C, and nitrogen, N, possess a marked similarity in the fact that the molecule of each is composed of two or more atoms united together with a bond representing a large amount of energy. Nitrogen, having an atomic weight of 14, has a normal molecular weight of 28, indicating two atoms to the molecule, and in this molecular form it occupies 79.2 per cent. of the volume of the earth's atmosphere. To separate this molecule into its constituent atoms and cause these atoms to combine with other elements is the problem of the fixation of nitrogen. Unless combined in the atomic form, the enormous bond between the atoms causes them to combine upon themselves into the inert form of molecular or atmospheric nitrogen. The ordinary compounds of nitrogen are formed only by the expenditure of a large amount of energy, the union of molecular nitrogen, N_2, and molecular oxygen, O_2, to form nitric oxide, NO, being represented by the formula,

$$N_2 + O_2 = 2NO = -43{,}000 \text{ calories}$$

Or in other words, to form one gram molecule of nitric oxide, NO, requires the expenditure of energy amounting to 21,500 calories.

The general similarity to carbon in this molecular inertness makes an interesting comparison.

Thus

$$2\ CO + O_2 = 2\ CO_2 = 134{,}000 \text{ calories.}$$

$$C_2 + O_2 = 2\ CO = 58{,}000 \text{ calories.}$$

The formation of one gram molecule of CO therefore represents the liberation of 29,000 calories while the formation of one gram molecule of CO_2 from CO represents 67,000 calories or a total of 96,000 calories in the formation of CO_2 from the original elements C and O. When amorphous carbon therefore is caused to assume the gaseous condition and unite with a molecule of oxygen there is liberated 29,000 calories but after assuming this condition in which the molecule is no longer composed of the inert carbon molecule, a second gram molecule of oxygen units with the CO and liberates 67,000 calories additional. The second molecule of oxygen therefore liberates 38,000 calories more than the first molecule, and as the oxygen molecules were alike this energy represents the bond uniting the carbon atoms and the energy necessary to break down the bond between these atoms and produce a gaseous condition from the amorphous condition.

Returning to the nitrogen molecule, it is apparent that the formation of the gram molecule of NO requires 21,500 calories in comparison to carbon liberating 29,000 calories to form CO; that is, the nitric acid reaction is endothermic while the carbon monoxide reaction is exothermic. Upon adding a second molecule of oxygen to the nitric oxide to form the peroxide we find,

$$2\ NO + O_2 = 2\ NO_2 = 27{,}000 \text{ calories}$$

or 13,500 calories per gram molecule are liberated after previously expending 21,500 calories to form NO. Since there is liberated only 13,500 calories upon adding a second molecule of oxygen, the net energy required to form the NO_2 would be 8,000 calories. The first molecule of oxygen required 21,500 calories whereas the second required only 8,000 calories, so that 13,500 calories were required by the nitrogen molecule to prepare it for combination with the oxygen.

[The May 15 issue of Electdical News will contain a description of the chief electrical methods of manufacture to date. —Ed.]

The Turn of the Tide

An encouraging note is struck in the current issue of Telephone Talk, the little magazine published by the British Columbia Telephone Company. It points out that net increases in the number of subscribers took place in March, as compared with February, in Vancouver and Victoria, as well as in several of the smaller exchanges of the company. A net gain is also noted for the province as a whole. This would indicate that this province has resumed its forward march.

That steady expansion is expected is further shown by the announcement that the telephone company has in hand estimates of $32,796 in Vancouver; $1,790 in North Vancouver; $22,145 in Victoria, and $5,750 in Nanaimo, as well as improvements in hand at Courtenay and Ladysmith. During the past few months the company have been perfecting their equipment wherever tests showed that improvement could be made and also have been doing work on many of their exchange buildings so that everything will be efficiently maintained.

The St. Marys Water, Light & Heat Commission are said to be reimbursing such of their customers as may have to discard their 60 cycle motors in coming over to the hydro lines, by a payment of 25 per cent. of the original cost of the motors and by endeavoring to make a sale of these old motors.

Hudson Bay Co. Vancouver Store

Isolated Plant and Electrical Equipment is Now Complete—One of the Finest on the Pacific Coast

By R. L. Vaniman, B.S.

Vancouver, British Columbia, now claims one of the finest isolated plants on the Pacific Coast in the installation just completed in the new Hudson's Bay Company's departmental store. The equipment is complete in every detail, and the building is not dependent on, nor does it have connection with, any outside source of electrical service for light and power.

The store building at present is a concrete structure having a frontage of 120 feet on Georgia Street and 175 feet on Seymour Street, and is six storeys in height, with an additional two storeys underground—a basement and sub-basement. Eventually it is proposed to extend the building along Georgia Street to Granville Street, making the frontage 260 feet, and to add four storeys, making the completed building 175 feet by 260 feet and ten storeys high, exclusive of the two floors underground.

The exterior of the building is finished in white terra-cotta; the windows are exceptionally large, thus obtaining maximum illumination from natural light. The interior woodwork, as well as the outer doors, is mahogany, and all the shop fixtures are of the same material. The effect is very pleasing and rich in appearance, and entitles the store to the distinction of being the finest of its kind in Western Canada.

The Power Plant

The present power plant consists of two 300 horse-power water tube boilers burning oil fuel, set singly; two 480 h.p. Corliss engines direct connected to two 300 kilowatt direct-current compound wound three-wire generators; a 20-ton refrigerating plant; a vacuum cleaner system, and various auxiliary apparatus, as ventilating fans, pumps, air compressors, etc. Provision has been made for the completed building in the design of the plant, and at that time it is proposed to add two 300 h.p. boilers and two steam generating units of the same type as now installed. To this end all piping has been made sufficiently larger than required for the present building, as have the electric feeders, the switchboard and the auxiliary apparatus.

The Corliss engines are rated at 480 h.p. but are capable of developing 600 indicated h.p. continuously for a period of four hours. The generators are also capable of carrying a load of 375 kilowatts for two hours, with a maximum rise in temperature of 60 degrees Centigrade above the surrounding air; these machines are three-wire of the Dubrowolsky type, and are connected to the switchboard by means of underground cable in conduit. The compensating coils are located behind the main switchboard and are connected in the same manner. The voltage of the generators is 220 volts at no load, with a compounding effect giving 228 volts at full load; 220 volts are used for the power circuits and 110 volts for all lighting circuits.

The main switchboard is of two-inch blue Vermont marble, surmounted by a marble cornice; is 33 feet long and stands six feet away from the wall, one end being returned to the wall by means of marble slabs, in which is set a copper grille door. The board is made up of thirteen panels, eight of these bearing the light and power switches, one the totalizing instruments, and the remaining four are generator panels, of which two at present are blank. The light switches are all single throw triple pole fused, with enclosed cartridge fuses mounted on slate slabs in the rear of the board, and the power switches are single throw double pole, fused in the same manner. Copper name plates above all the switches indicate the portion of the building or piece of apparatus controlled by them. Switches were used on power circuits instead of circuit breakers, as in the case of a short circuit on a power line the fuse will "blow" before the main line circuit breakers open, thus preventing a cessation of the service. It often happens, that the action of circuit breakers on power lines is so slow that the main circuit breakers also open. It is obvious that continuity of service is imperative in the lighting of a departmental store, and must be given first consideration in the design of the electrical system and apparatus.

Function of Totalizing Panel

The totalizing panel carries a totalizing ammeter which indicates the total current output of the generators, two Thompson astatic integrating wattmeters—one to record the output for lighting service and the other for power, ground detector lamps, a voltmeter switch, an ammeter switch and an electrically operated clock. On each generator panel are mounted two ammeters for reading the current on the two legs of the system, a double pole interlocking circuit breaker, one single pole and two double pole switches, and a field rheostat and voltmeter plug. At the end of the switchboard is a bracket carrying two voltmeters, and by means of these meters and the arrangement of the voltmeter plug wiring, the voltage of the busbars and the incoming machine may be read simultaneously when paralleling generators.

There are two sets of busbars, one for light service and one for power. These busbars are tapped to the various switches by copper straps, and from these copper rods extending up through a slate slab at the top of the board connect to the outgoing feeders by means of heavy lugs. Directly over this slab is a sheet-iron junction box in which the cables distribute to the several conduits.

The power feeders supply current to the motors driving the ammonia compressor, air compressors, elevators, ventilating fans, pumps, belt conveyors and cash tube blowers, a total of forty pieces of apparatus having a total capacity of 70 h.p. Where more than one motor is supplied by a single feeder, a marble slab upon which are mounted the necessary fused switches is used to reduce the wiring to the proper size for the several motors. All ventilating fans, motors, and the ammonia compressor and vacuum cleaner machine motors, are provided with speed controllers giving speed reduction below or increase above normal by armature and field control respectively. Several of the pumps are controlled automatically by float switches located in the tanks or sump pits; others by pressure regulators which start the pumps when the pressure drops to a certain predetermined value, and stops them when the pressure is raised a certain amount.

The lighting feeders distribute to three panels on each upper floor; there is a panel located at each end of the building for controlling the lighting, and the third panel is located in the work room section. The panels are built of black slate and have three-wire busbar distribution. The work room panel has two 30 ampere two-wire 250-volt switches for power as sewing machine motors, etc., and eight two-wire 110-volt switches for lights over work tables, for pressing irons, glue pots, etc. The lighting panels have two-wire circuits controlled by push buttons; separate doors are provided over the switches, and over the busbars and fuses; enclosed cartridge fuses are used throughout.

A feature of the panels used for lighting, and not found in every building, is the two sets of busbars connected to separate feeders. One section controls the circuits to the lamps which are required to light the building for cleaning at night, and the other set controls the remaining circuits. During business hours both day and night circuits are used, if required; when the store is closed the switches at the main switchboard controlling the day feeders are opened, and the night lights can only be used. This saves waste of power and unnecessary use of lamps.

The lighting fixtures on the upper floors are finished in

bronze, and are of the type best suited for their location and the kind of illumination desired. In the sales space semi-indirect fixtures are used, while direct lighting is used in the stairs, halls and work rooms. Alba shades of pleasing design are used throughout the building. The first floor is lighted by means of intensified three carbon arc lamps mounted in ornamental bronze casings. These arcs require 4½ amperes at 110 volts and give about 1,200 candle-power; they are exceptionally free from the flicker usually characteristic of arc lamps, and by means of double opal glass globes the glare of the strong intense light is eliminated. These are controlled from panels, as are the lights on the upper floors.

The show window and marquise lights are controlled by three special panels on the first floor, each having six sets of busbars; two of these feed alternate lights in the marquise; one, the base receptacles in the show windows; and the remaining three supply current to the window reflector lights, each one controlling every third lamp. Each set of busbars is controlled by a triple pole fused switch, and the branch circuits have enclosed fuses, but not individual switches.

In the sub-basement one panel controls the lights in the shipping and packing space, one the lights in the engine boiler, and machine rooms, and a third has connected to it all the stair and hall lights throughout the building, also those lights located in front of elevators. By proper arrangement of the circuit light is insured in these important places even though one circuit be temporarily out of commission. A panel located in the pent house controls the circuits to the roof standards; all wiring to these standards is done with lead-covered waterproof wire.

On the second, fourth and sixth floors two additional panels have been installed and conduit run from same to the exterior of the building in order that, at any time, the windows may be outlined by strings of incandescent lamps by simply pulling in wires and connecting same to the panels.

The show cases are lighted from circuits taken from the light panels on the various floors and terminating in floor boxes or base plugs. Each case has a separate push button switch mounted in a recess in its base, thus giving individual control of case lights.

Signal and Fire Alarm Systems

In a conspicuous place on each of the sales floors there is a light bracket having four different colored lamps, and a gong is located nearby. This is used as an employees' signal system, and is operated by a control board at the city telephone exchange located in the building. By pushing a button the gongs ring on all floors, and four push buttons, having pilot lamps of same color as those in the brackets, control the lamps of respective colors on all floors. Four important employees, who might be needed or wanted at various points in the store, have a particular color assigned to each of them. In case request is made to a salesman for one of these employees, the salesman at once telephones the exchange operator; the operator, in turn, rings the gongs and lights the lamps of that particular color assigned to this employee. The person being signalled sees the lighted lamp and calls the telephone operator to determine at what part of the building his presence is required or desired; by this system, much time is saved both the customers and employees of the store.

There are a number of low-tension or battery operated systems in the building, which are quite interesting and useful; these include the two fire alarm systems, the time clocks, the watchman's detector, the temperature indicators and the three telephone systems. There are two fire alarm systems, but neither has direct connection to the city fire station. The reason for this is obvious when one considers the unnecessary risk of life by a panic should a false alarm be turned in by some meddlesome person, a reason which only applies in public buildings where large crowds congregate. One of the systems has break glass stations of the Edwards type, and the gong in the engine room can be rung, not only by breaking the glass, but also by a key, the latter being used for testing purposes. This is called the house or interior system, and is used when a small fire occurs which is not likely to require the services of the City Fire Department. An annunciator in the engine room indicates the portion of the building from which the alarm has been turned in.

The other fire alarm system is of the Gamewell type, and can only be operated by breaking a glass and pulling down a lever, this causing a gong to ring in the engine room and operating an annunciator which indicates the location of the alarm in the building. When an alarm is turned in on this system the engineer knows at once that the fire threatens to be of a serious nature, and he immediately turns in a city alarm by means of an auxiliary city box located near the annunciators of the two systems. Two stations of each system are located on each floor.

For fire drill and alarm purposes there is a gong located on each floor connected to the engine room. By a system of switches one or all of these gongs can be rung as desired or considered necessary by the engineer.

Electric Clocks and Detector System

On each floor there is an electrically operated 18-inch dial clock enclosed in a handsome spun copper case; in addition, there is a similar clock located on the main switchboard. These clocks are all operated by impulses transmitted at 30-second intervals by a master clock of the mercurial compensated pendulum type, guaranteed not to vary more than ten seconds per month.

The watchman's detector system consists of three key-operated stations on each floor, and a master station in the store superintendent's office. The master station has a chart on which are marked the station numbers, and on which lines are drawn representing ten-minute intervals. Turning a key in a station transmits an impulse to the master station operating a magnet with a pin point on its armature, which punches a hole in the chart. By this method the movements of the watchman are graphically recorded, and his position in the building at any time can be determined at once by a glance at the chart.

A low-tension system of great importance to the operating engineer, and which does much towards insuring comfort to the patrons of the store, is a temperature indicator system. On each floor, at opposite ends of the sales space, there are located two temperature indicators which are electrically connected to an indicating board in the engine room. This board consists of a row of keys and a number of pilot lamps mounted behind small circular glass windows, on which are numbers indicating degrees Fahrenheit. When a key is pressed the temperature of the part of the particular floor controlled by this key is indicated by a lamp which illuminates the number denoting the temperature in degrees Fahr. Each temperature indicator throughout the building has a corresponding key and, in addition, there is an indicator located on the exterior of the building for denoting outside temperature, also having an individual key.

Very Complete Telephone Service

There are three separate and distinct telephone systems in the building. The store has its own private branch exchange, to which 100 telephones throughout the building are connected; this exchange is connected by a number of trunk lines to the local city exchange of the British Columbia Telephone Company. In addition there is an order room, which is really a small private exchange, it being connected by trunks to the store's private exchange. Customers call the store to give orders and are at once connected to the order room, where efficient clerks note down their orders and then send same to the various departments concerned to be filled. This saves the customer the inconvenience of dis-

(Concluded on page 44)

Electric Railways

Steam Railway Electrification

By W. S. Murray*

That a thing of any character has the right to live and improve is based entirely on whether it is founded on correct principles. In the early days, when electrical movement was first introduced on heavy traction railroads, theory was strong and practice severely limited. The guiding principle upon which electrical men based their opinions that electrification had its proper place in the economic world was that by its use certain savings could be effected that would justify the investment necessary to secure it. There was entirely outside of this, but indirectly an economic factor, the advantage accruing to the passenger in the form of a clean ride. While I have, of course, been keenly interested in electrification that has been applied to other railroads, naturally the past 10 years' association with the New Haven work, during which time over $15,000,000 have been expended in this department of betterment, has brought the real elements of its progress within very close range.

In June, 1914, the first New York, New Haven & Hartford passenger train was operated from Grand Central Station to New Haven over a four-track electrified route of 73 miles in length. Between New York and New Haven, measured upon a single track basis, there are some 500 miles of electrified line, of which 184 are included in yards and sidings. On these tracks to-day, every class of passenger, freight and switching movement is made, and electrical statistics are kept of all power house, line or equipment failures, a reference to them suggesting the features of electrical operation that requires first attention for the betterment of service.

While our present freight movement by electricity on the main line is to-day limited both on account of the general depression in business, together with the fact that a full complement of electric freight locomotives is not yet at hand, there is no question in my mind but that the greatest returns to be secured by electrification will be through freight movement. While in the past we have appreciated the economies to be secured through electrification, by virtue of the lesser expenditures required in fuel and maintenance of electric engines as against steam, there is fast coming to the front what might be called a more visualized economy in the reduction of expenses by effective savings in train miles.

Illustrative of the economic value of a "kilowatt hour" in its application to an electrification system, I quote from a part of a recent letter which had reference to the utilization of some 4,500 kw. of demand in connection with its application to the eastern section of our electrification zone. I would particularly draw your attention to the item of $49,275, which has reference to the economies to be gained by the double heading of freight trains operated between Harlem River and New Haven. This economy, and its automatic complement, the increase of track capacity, are the phases of electrification that are striking deep into the consideration of the steam operating railroad man.

"(1) The extension of the station contemplates, as you know, supplying a maximum single-phase demand of approximately 4,500 kw. This amount of power, measured by train units, would permit the operation of 12 additional daily trains in fast freight service of average tonnage or its equivalent in any other class of service between Harlem River and New Haven.

"(2) The number of kilowatt hours which would be consumed by the above trains would be 17,500 kw.h. annually, and, upon a coal ratio of 1 to 2 in electric and steam service and a basis of 3 lbs. per kilowatt hour and $3 per ton, an annual saving to the railroad company of $78,750 is indicated.

"(3) Further translating the above movement into engine miles, our log sheet records indicate that the number of engine miles required for the above movement would be 990, which, multiplied by the difference in cost of engine repairs at five cents per engine mile, effects an annual saving of $18,250.

"(4) The transfer of 12 daily trains from steam to electric service will permit a further extension of our present practice of 'double heading' trains in electric service, thus saving 450 daily train miles, which, as shown by our log sheet, will secure an annual reduction in train wages of 30 cents per train mile, corresponding to an annual reduction of $49,275.

"(5) A supply of approximately 3,000 kw. (average) to the New Haven end of the line will effect a further saving of $16,500 in transmission losses, as compared with the transmission losses of the same amount of power from Cos Cob Station, the above savings being based upon the conservative cost of 5 miles per kw.h. In explanation of the apparently large value of the saving in transmission losses to be effected by this small installation, it will be evident that its value is a maximum when applied at the extreme end of the transmission system.

"(6) No tangible values can be assigned for the very important effect upon the regulation in line voltage at New Haven, which will be reflected in the cost and efficiency of operation in many ways.

"(7) The summary of the total savings as above which will be effected is as follows:

Fuel	$78,750
Engine repairs	18,250
Engine and train wages	49,275
Transmission losses	16,500
	$162,775"

If any criticism can be placed with regard to the matter of freight movement by electricity, I would say it would be in the matter of speed. The electric freight locomotives of the New York, New Haven & Hartford were built on specifications that permitted them to operate 1,500-ton trains on level track at 35 miles per hour. While the speed element, in as far as the New Haven service is concerned, may be entirely justified, due to the very large ratio of passenger

* Consulting Engineer, New York, New Haven & Hartford. Extract of paper read before Western Society of Engineers.

to its total service, thus permitting the freight trains to clear promptly for passenger traffic, I would say that where the ratio of passenger service is less, the speed element for equal horse-power could be more valuably thrown into traction. For example, the New Haven locomotives have drawbar pull characteristics that permit the operation of 3,000-ton trains by double-heading. If these engines were reduced in speed by 35 per cent. and their traction increased by the same percentage, 4,000 tons would be the resulting double-header trailing load, which in turn would effect a large saving in train miles, were these engines to be operated on a property less subject to passenger movement.

Reliability of Switching Gear

Much valuable information has been developed in the past two years in connection with the handling of classification and switching yards by electric motive power. An idea as to the reliability of this class of service may be gained in saying that in 1,000,000 electric switch engine miles there has been but one failure. The New Haven property includes in it two large switching yards; the Oak Point yard, containing 35 miles of track, and the Harlem River yard, 25 miles. The introduction of the electric engine in these yards has increased the speed of the yards very greatly, and, as nearly as I can gather from the yardmasters, this increase of speed has been secured with a ratio of electric engines to steam engines replaced varying between 4 to 6 and 6 to 10.

Electricity in trunk line territory is now on a plane of consideration entirely different from the earlier days, when it was new, untried, and problematical.

It would seem very inappropriate, with so good an opportunity as this, not to say a word or two as to "system." I am frankly willing to admit that I am a firm believer in the single-phase system for trunk lines, the governing element in which, from an electrical standpoint, has been the transmission system. In a rigorous determination to adhere to this principle as correct for such a field it has not been to gainsay the application of direct current in the territory where it rightly belongs, namely, where the governing element has been (mass trains under acceleration and braking in close headway) in translation. As a citation of the two examples, I would offer: (1) The electrification from New York to New Haven, and (2) the electrification of the New York subways.

In closing my address I would speak of two things which to my mind are most pertinent to the advance and successful utilization of electricity in the field of heavy traction. The first is with reference to the mercury arc rectifier, and the second is in regard to the effect of electrical administration on the railroads electrifying.

With reference to the mercury arc rectifier, I feel sure that it will be of interest to state that a car has been in commercial operation on the New Haven road taking power from the 11,000-volt overhead contact system, and converting it into direct current for application to its propulsion motors. This car has been giving a most successful service, and the problem of the production and maintenance of the vacuum tube, through the agency of which the alternating current is converted into direct current, has been electrically and commercially solved. What are the possibilities accruing from such a result? This can be epitomized in the statement that if the economies in the transmission system of the single-phase justified the utilization of a heavier and less efficient motive power, to-day we are in a position not only to secure the economies gained in this transmission, but operate beneath the contact wires of such a system the more efficient and lighter direct current apparatus. As a concrete and practical application of this result, the present alternating current motive power now in use on the New Haven will be increased 25 per cent., by the application of the rectifier, and will also permit it to enjoy simultaneously transmission and motive power facilities of the highest order of efficiency.

Time to Regulate the Jitneys

The big question in city transportation to-day is the jitney. No fad in recent years has had a more rapid growth. This no doubt is due to peculiarly favorable circumstances, chief of which is the very large number of used automobiles lying practically idle or on sale for a small fraction of their original cost, as a result of the general financial stringency. There is no doubt, too, that their popularity with a large percentage of their patrons is in no small measure the result of the novelty of this method of transportation—the luxury of an automobile being one to which they are not accustomed. It would be difficult on any other supposition to understand why ten or twelve or more passengers seem content to be packed into a space which, at best, is only intended to accommodate four or five. The worst street car overcrowding could never provide the some amount of discomfort.

It is difficult to foresee how the popularity of jitneys on the present basis can be anything more than a passing fancy. It is very certain that municipalities are awakening to the necessity of passing regulations to govern such factors as speed, taxes, licenses, personal and property liability, and so on, which will incur considerable expenditures on the part of the jitney owners. Whether the receipts will bear any such further inroads has yet to be proven by experience, but theoretically and mathematically they will not. It looks rather as if the continued existence of this type of service depends on their giving a more exclusive, comfortable and speedy transportation than the electric railway companies, for which necessarily they would make a commensurate charge. That is, they might fill the needs of the man who cannot afford a car of his own, but yet is able and willing to pay for a little better service than the street railway can afford to give.

In the meantime, the safety of the public demands that certain restrictions be placed on the operation of these vehicles, and the following extracts from the Electric Railway Journal indicate in a general way what has been done in the United States, where the jitney growth has been very rapid,—

Bond For $10,000

The ordinance intended to regulate the jitney in Houston, Tex., has been adopted by the City Council, and automobile owners who desire to comply with the terms of the ordinance have thirty days in which to make their arrangements. The ordinance provides that jitney operators shall furnish liability insurance in the sum of $10,000 or give a personal bond for that amount for the protection of the public. It also carries the usual wheel tax of $12 a year for each car, and in addition a provision fixing the tax for ordinary touring cars for jitney service at $1 a month and the tax for the buses carrying ten or more passengers at $50 a year. Under the ordinance the Public Service Commissioner of the city is vested with authority to grant licenses and permits, regulate schedules and designate terminals of each line, subject to appeal to the City Council. Each application for a permit must show the names of each and all who are to drive the car, the type of car, horse-power of the machine, factory number, county license number, seating capacity, terminals of the line, streets to be used and the schedule of departure and arrivals. Before receiving the permit to operate the drivers are to be examined by a board composed of the superintendent of police, the city attorney and the person in charge of the city automobile repair shop. No passengers will be allowed to ride on the running boards, fender or door and only one passenger will be allowed to ride in front with the driver. One conviction of a driver suspends his license for ten days and the third conviction will revoke the license permanently. Any person who violates any provision of the ordinance is subject to a fine of not less than $5 or not more than $25.

On March 31 the City Commission of Salt Lake City,

Utah, passed an ordinance regulating the operation of motor buses for hire over the streets of Salt Lake, effective on April 1. It is aimed solely at the regulation and control of the jitneys operating in competition with the street railways. It provides for the licensing of such cars at the discretion of the City Commission, such license to be limited to certain routes and terminals designated in the application for license. Regular schedules must be maintained by all such cars from six o'clock in the morning until midnight every day, including Sundays and holidays. The application for license must contain information as to the name, age and residence of the owner and operator, type of car, power and seating capacity, license number, factory number, route, terminals and schedule to be maintained. Cars with a seating capacity of four passengers or less are to pay the city $75 a year license, cars with more than four or less than ten passenger capacity are to pay $100, and cars of more than ten passenger capacity are to pay $125. After dark every car is to be artificially illuminated on the inside and also on the outside to show the route and terminals. The ordinance makes it unlawful to run on any streets other than those designated in the route. It is unlawful to run past or within 25 ft. of any other motor bus or any street car for the purpose of reaching a prospective passenger first. Policemen, firemen and employees of the city health department when wearing uniforms must be carried free. Drivers are forbidden to charge or receive any amount in addition to the regular passenger fare for the transportation of hand baggage. It is unlawful to cross any railway track without first bringing the car to a full stop. A bond of $5,000 is required for the protection of passengers against damage from injury to themselves or property. The license of any owner or operator may be revoked by the city at any time if it appears that the owner or operator is a careless or reckless driver. Any violation of the ordinance is deemed a misdemeanor and is punishable by a fine not exceeding $50 or thirty days in jail, or both. On second conviction the license may be cancelled.

Pay Stiff License Fee

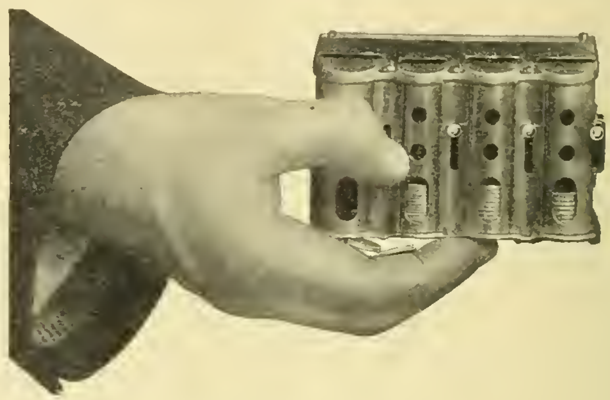
The public utilities committee of the San Francisco Board of Supervisors tentatively adopted a proposed jitney bus ordinance on March 31. The outstanding features of the proposed ordinance provide for insurance of the jitney patrons against accident and the payment of an annual license by the jitney owners, graduated according to seating capacity. The insurance feature is designed to provide a policy which shall yield a maximum of $5,000 in case of accident causing injury or death, and $10,000 if two are hurt or killed. In addition to this the policy must provide for payment of $1,000 in the case of property damage. It is provided that jitney owners shall pay the premiums on these policies, but in event of recovery in court for damages it is to be provided that the injured party or his heirs, in case of death, may receive their insurance from the insurance company itself. The license feature of the proposed ordinance provides that owners of jitneys shall pay a license fee to the city of from $40 to $100 per annum, according to the seating capacity of their vehicles.

Limitation of Streets

The special joint committee of the City Council of Little Rock, Ark., has agreed upon the terms of the ordinance to be passed by that city to regulate the jitney. The surety bond is fixed in the sum of $5,000 for each automobile let for hire. Other provisions include the definition of streets on which public automobiles may be operated, limitation of the number of passengers the cars may carry and requirements for licenses. The seating capacity specified by the manufacturers of the cars is to be the maximum number of passengers which may be carried. Licenses are fixed at $3 a month for drivers of five-passenger cars, $4 a month for seven-passenger cars, $6 a month for eight to twelve-passenger cars and $8 a month for larger cars. These licenses are to be payable quarterly and are in addition to the regular vehicle licenses. The inspection of public automobiles is provided for through the creation of an automobile inspector, who will pass upon the fitness of automobiles for public service and the qualifications of chauffeurs. The penalty for violation of any provision of the ordinance is fixed at not less than $5 or more than $25.

Improved Change Carrier

A conductor's change carrier improved by the addition of thumb levers which eject coins from each of the four compartments, has just been put on the market by the McGill Ticket Punch Company, Chicago. This device is made of brass throughout, the standard outfit containing four compartments, two for nickels and one each for dimes and quarters. It will also be made with compartments for pennies or for Canadian coins. One of these improved change carriers is shown in the accompanying illustration. Its advantage lies in the fact that simply by pressing down one of the



thumb levers with which each compartment is fitted, coins are ejected one at a time and as rapidly as desired. The ejectors have been so placed that the hand naturally assumes the proper position for receiving the ejected coins. Also the rapid, easy ejection of coins, one at a time, permits the operation of this change carrier with gloved fingers and the receipt of a coin with each operation.

First 3000 Volt d. c. Operation

Recent announcement has been made of the closing of contracts for the electrification of the first section of the Chicago, Milwaukee and St. Paul Railway, a work which, when complete, will comprise some 440 miles or, including yards and sidings, approximately 200 miles in excess of this. Contracts have been let to the General Electric Company, of Schenectady, for the electric locomotives, sub-station apparatus and line material. The locomotives will have a capacity of 3,440 h.p., said to be the largest ever built. Each locomotive is supplied with eight motors, each on its own driving axle, these motors to be arranged two in series for normal operation.

A contract has been closed with the Montana Power Company for a supply of power throughout the complete length of the line. This power will be transmitted at 100,000 volts and stepped down by means of transformers and motor-generators to 3,000 volts direct current. This is the first direct current installation using such a high voltage and the decision in this case has no doubt been very largely influenced by the highly successful operation during the last couple of years of the Butte, Anaconda & Pacific Railway System at 2,400 volts direct current.

The Dealer and Contractor

The Eye and Illumination

A Sufficiently Close Relationship to Demand Attention—The Illuminating Engineer Also a Physiologist

By H. E. Mahan*

The eye passes final judgment on a lighting system and, therefore, should receive consideration from the illuminating engineer. To do so, however, the engineer must leave the domain of physics with its exact formulae and enter the field of physiology. Here he finds the available knowledge rather limited and uncertain. He is not dealing with the rational and co-ordination laws of light, heat and electricity, but with the delicate, human organ of the sense of sight—the eye. True, scientific investigators have provided us with much information on the general action of the eye and its relation to light, but there still remains a great deal to be learned before we can make exact allowances for its behavior under artificial lighting systems.

The Anatomy of the Eye

The human eye is illustrated diagrammatically in Fig. 1 and is shown to consist of six essential parts, namely, the cornea, the anterior chamber containing the aqueous humor, the iris, the crystalline lens, the cavity containing the vitreous humor and the retina. From the following description and the accompanying diagram, it will be observed that the eye resembles very strongly the modern photographic camera.

Let us follow a ray of light through the eye, observe its path and the actions and processes it sets up. The light is admitted through the cornea, a transparent extension of the eyeball shaped somewhat after the fashion of a watch crystal. It passes through the aqueous humor, a transparent jelly-like substance, and reaches the iris. The iris is the colored part of the eye and consists of a circular curtain, a continuation of the middle or choroid coat of the eye and is capable of increasing or decreasing the diameter of its opening—the pupil—allowing more or less light to pass through as is required for correct vision. The light next strikes the crystalline lens, a transparent elastic body controlled by a muscular ring—the ciliary muscles—which enables it to change its curvature to accommodate or focus the eye. Passing through the vitreous humor, the light reaches the retina, which is the delicate network of nerve centres, possessing the property of converting the radiant energy into a sensation of sight. The retina plays such an important part in the process of seeing that it may interest the reader to know a little about its essential structures.

Rod and Cone Vision

The retina is a very complex structure which, while only about 0.01 inch thick, is composed of ten separate layers, but for the purpose of this article we will consider it as consisting of tiny nerve centres called rods and cones from their shape. The cones are most numerous in the fovea, which is the point of greatest sensitiveness, the ratio of cones to rods decreasing toward the outer regions of the retina. The rods are believed to be active in the determination of form and brightness and the cones in color perception. Furthermore, in dim illumination the rods only are effective, while for higher intensities the cones become active and colors are sensed. You have perhaps experienced at twilight the ability to see objects, although unable to distinguish their color. The cavities at the ends of the rods contain a bluish watery-fluid called visual-purple, which is continually being decomposed by the action of light and constantly replenished from the pigmentary cells in the choroid coat of the eye. However, when the eye is subject to too strong an intensity of light this visual purple is bleached out more rapidly than it can be secreted, with the result that the vision is dimmed or blurred. Darkness or dim illumination will usually enable the eye to recover its normal condition.

Color Vision (Young-Helmholtz' Theory)

The most reasonable theory of color seasation and the most generally accepted one is the theory propounded by Dr. Thomas Young in the early part of the nineteenth century and more recently elaborated upon by Helmholtz. This is known at the Young-Helmholtz' theory and assumes the retina of the eye to have three sets of cones, one sensitive to red light, one to green light and one to blue light. These colors—red, green and blue—are known as the primary colors. When all three sets of nerves are stimulated, the sensation of white light is realized; when excited separately the sensation corresponding to the set of nerves responding is set up. Intermediate colors are perceived by the three different sets of cones in varying degrees of excitation. The curves illustrating this theory are shown in Fig. 2. The curve for each color sensation is shown to extend beyond the point on the spectrum for which that particular set of cones is particularly sensitive, so that they overlap each other and thus permit of intermediate color sensations.

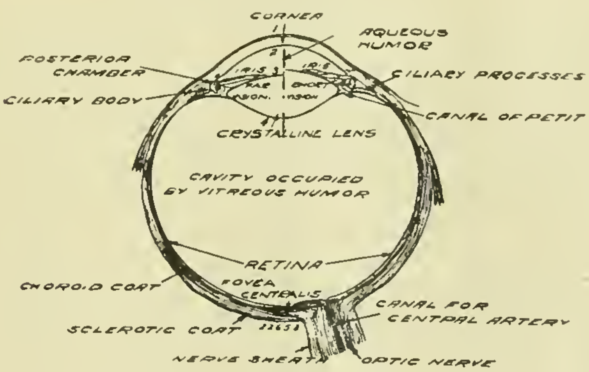


Fig. 1

The Eye as an Optical Instrument

In its path through the eye, the light encounters four refracting mediums, namely, the cornea, aqueous humor, crystalline lens and the vitreous humor, having indexes of refraction of approximately 1.37, 1.34, 1.437, and 1.34, respec-

* In General Electric Review.

tively. These refracting surfaces are shown at 1, 2, 3, and 4 on diagram, Fig. 1. It will also be noted that the eye, unlike most optical instruments, does not focus by changing the distance between the lens and the retina, but by changing the shape of the lens. This is shown by Fig. 1, the position for nearby and distant focus being indicated.

The eye is subject to the principal defects of the ordinary optical instrument. These are spherical aberration, which causes the central part and the edges of the crystalline lens to focus in different planes, and chromatic aberration or the failure to focus all colors in the same plane. These errors do not enter to any serious degree and cause us no inconvenience in the ordinary process of seeing. On the other hand, the eye is capable of functioning through a wider range of intensities than would ordinarily be expected from any scientific instrument. It serves us with equal convenience for intensities corresponding to faint moonlight or to the direct rays of the noonday sun—a ratio of about 1 to 5,000,000.

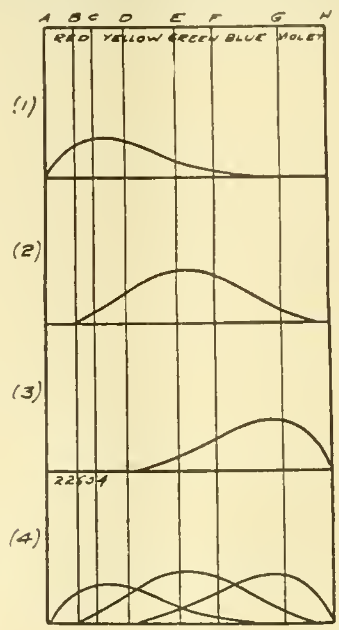


Fig. 2

The Eye, Light and Color

The eye responds to radiations having wave lengths between approximately *0.76μ and 0.39μ, or, in other words, the visible spectrum extends through slightly less than one octave. The long wave lengths give the sensation of red and as they grow shorter pass in succession through all the colors of the spectrum: Red, orange, yellow, green, blue, indigo, violet. Waves longer than the visible red and shorter than the visible violet are termed, respectively, infra-red and ultraviolet. These waves do not excite the retina, but the former may be realized as heat and the latter are characterized by their chemical activity. These properties exist in the visible spectrum to a certain extent, diminishing from the two extremes mentioned to a minimum about at the yellow. Furthermore, the eye does not respond with equal sensitiveness at all points of the visible spectrum, but follows the sensation curves shown in Fig. 3. These curves indicate a zero response at the extremes of the spectrum and a maximum response near the middle, shifting toward the blue for faint illumination and toward the red for strong illumination. In other words, for an equal quantity of energy converted into light, the maximum physiological effect will be obtained from green-yellow light.

There also exists a quantitative relation between the stimulus and the sensation, that is, between the intensity of illumination and the visional impression. This relation is known as Fechner's Law and states that the least perceptible increment is proportional to the whole stimulus, that is, the same percentage change in intensity of illumination calculated from the least amount perceptible to the eye gives the same change in sensation. This is graphically shown in Fig. 4 by the logarithmic curve of intensities. The practical application of this law in guiding the engineer in reaching an economic compromise between intensity of illumination and quantity of power expended is self-evident.

*μ = .001 millimetre.

Intrinsic Brilliancy and Glare

One of the fundamental laws to be observed in placing light sources is to avoid locating lights of high intrinsic brightness in the field of vision. Intrinsic brightness is defined as the candle-power emitted per unit area of surface. For comfortable vision this value should not exceed 5 to 10 candle-power per square inch. When the eye is compelled to view surfaces which exceed this value, there is likelihood of eye strain, a decided decrease in visual acuity and perhaps permanent injury. This condition may also be brought about by specular reflection from a glossy or polished surface, as is often experienced in reading a book having calendered paper.

Glare, as a cause of industrial and traffic accidents is receiving attention from "safety first" advocates. We all have experienced the difficulty of seeing behind the powerful headlights of an automobile or of trying to see with an unshaded incandescent lamp shining in our eyes. These are everyday examples of glare and might be multiplied many times. A trip through almost any industrial plant will furnish evidence of lowered production, increase of spoilage and general inefficiency of workmen, due to glare in some form or other from the artificial lighting system.

You will recall previous mention of the iris, i.e., the diaphragm controlling the pupillary opening in the eye. The size of this opening is regulated in accordance with the brightness of the field of vision, being made large to admit more light in the case of a dim field and reducing the opening to exclude excess light when exposed to a bright field. Furthermore, the pupil is regulated to conform to the brightest area in view; therefore, when we have a bright light in front of our eye the pupil contracts to protect the eye from the excess light and, hence, fails to admit sufficient light from the less brightly illuminated parts for vision. The sections of relatively lower illumination, therefore, appear underlighted or dark.

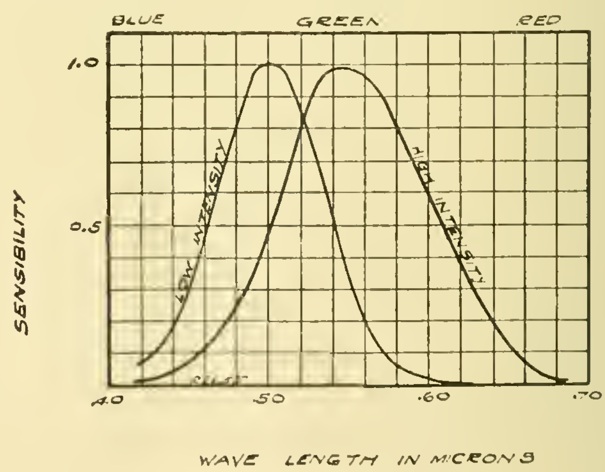


Fig. 3

There are two general ways of eliminating glare from a lighting system; these are, first, by removing the source from the line of vision as in cove lighting, totally indirect lighting by fixtures, or direct lighting with units placed well above the line of vision; second, the reduction of intrinsic brightness by enclosing the source in diffusing glass or screening by a correctly designed shade. All these methods involve a sacrifice

in efficiency as far as light flux is concerned, but this is usually compensated for by the increased facility for vision as previously outlined.

Diffusion of Light

Daylight provides the most diffused illumination and absence of shadows. It is this matter of diffusion of light and the presence of shadows that is responsible for many unsatisfactory systems of artificial lighting. For example, under daylight conditions in a factory the workman is surrounded by light of approximately equal intensity. In this same factory, under artificial lighting an operator may have at his machine an intensity perhaps greater than he received by daylight, but his surroundings will be many times darker, hence, when he looks away from his machine to the darker zones he suffers momentary blindness until the pupil is adjusted to the new conditions. This man, therefore, is disabled for a fractional part of his working hours, is incapable of performing his duties and, therefore, is an inefficient workman. Furthermore, at these times when the eye is incapable of functioning, the employee is more susceptible to accident from revolving machinery, etc. That this is actually the case is

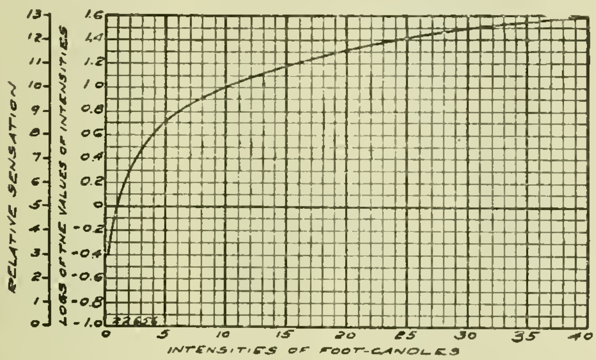


Fig. 4

illustrated by the statistics on industrial accidents, which show that the fatal accidents occurring during the short-day months of November, December, and January are about 40 per cent. greater than those occurring during the long days of June, July, August, etc. Strong contrast in illumination intensity or the presence of dark shadows are, therefore, inconsistent with good illumination and should be avoided.

Another source of ocular discomfort is a flickering light source, which causes the eye to continually adjust itself for fields of varying intensity. This causes a strained condition of the muscles of the eye and fatigue, preventing the iris from properly protecting the eye and leading in many cases to permanent injury.

Ultra-Violet Light

As previously stated, the eye does not respond to waves shorter than about 0.39μ, that is, to the ultra-violet light. This is because they are almost totally absorbed by the cornea and crystalline lens and because the retina is not responsive to them. Evolution may enable future generations to see these ultra-violet radiations and open up wonderful sights at present closed to us.

Ultra-violet light undoubtedly has an injurious effect upon the eye tissues when present in appreciable quantities. Whether it is the chemical effect of the ultra-violet or the heat effect of the longer wave lengths which has the greater injurious effect upon the eye is open to debate. The fact remains, however, that there is less ultra-violet radiation from artificial lighting sources than from daylight, which fact should dispel fear of ultra-violet light from commercial lighting units. A further protection is guaranteed the eye from the glassware used in connection with most lighting units, ordinary glass being opaque to the ultra-violet rays.

Conclusion

It is hoped that by this brief description of the eye and light it has been shown that there does exist a very important relation between them, and that this relation is of sufficient practical importance to demand attention. Legislators are awakening to this fact and are enacting laws that will protect workers and the general public against incorrect and inadequate lighting. Perhaps a fifth of the states have laws defining in a rather vague and indefinite way the lighting requirements for factories, while a much larger percentage have passed legislation covering the lighting of mines and the use of headlights. It is expected that these laws will be amended in the near future to embody the advances made in the science of illumination. Municipalities are turning their attention to this movement and exercising supervision over the illumination of streets, of schools and other public buildings.

In the industrial field, lighting is one of the first items to receive attention from the scientific manager. He appreciates and can actually prove that the quality and quantity of production is enhanced by providing favorable working conditions for his employees, that the liability of accident is minimized, sanitation and health promoted and the good will of the employee obtained thereby. These conditions are all furthered by a properly designed lighting system. All branches of human activity are dependent to a greater or less extent upon light, making it important and vital to the interests of mankind and deserving of study and consideration.

Nitrogen Lamp Store Lighting

The New Gas-filled Lamp, Furnishes Illumination of a Truer White and Consequently is Meeting Great Favor for Store Lighting

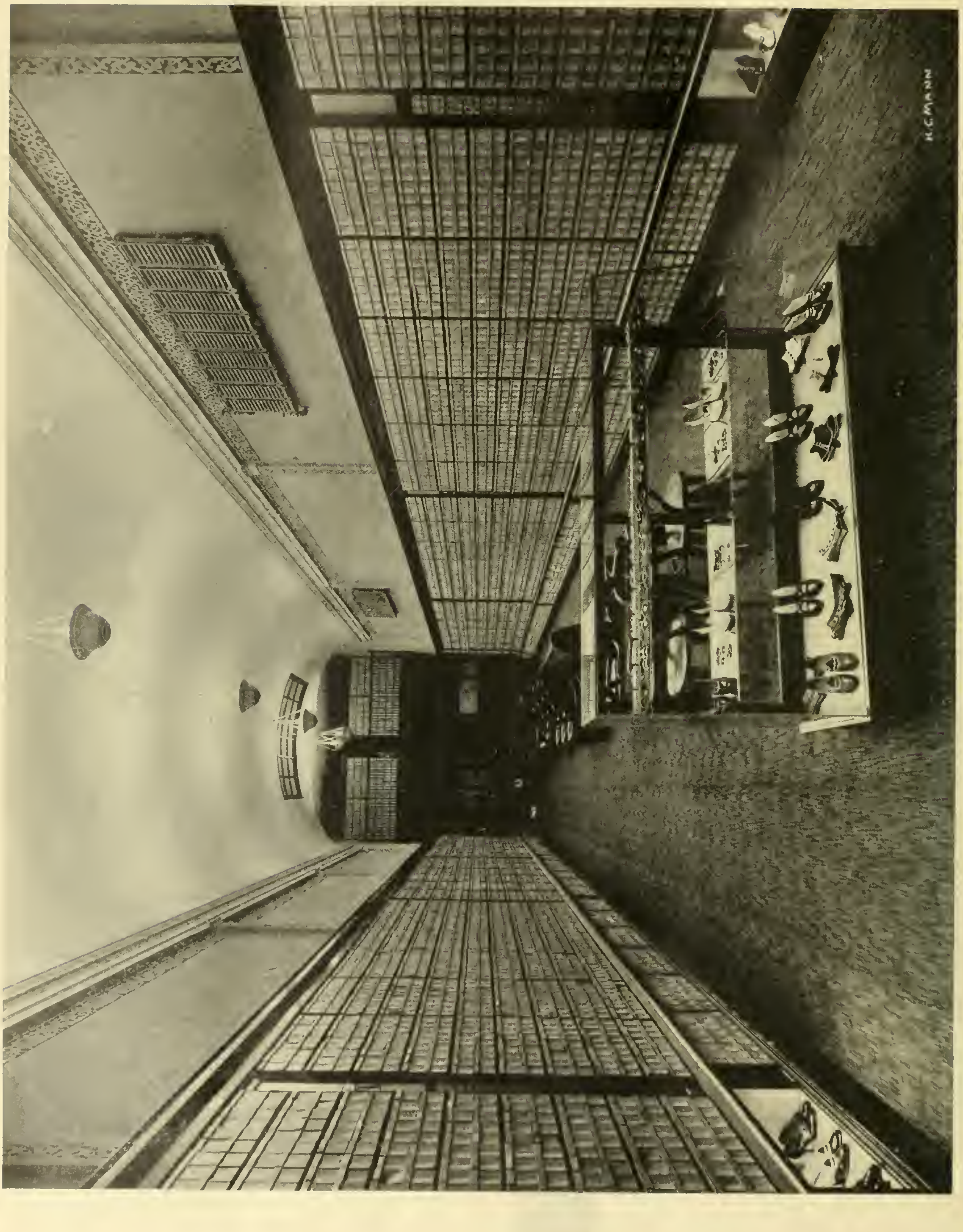
By John A. Hoeveler*

For many years, merchants have felt the need of a white artificial light. The vacuum tungsten lamp in large sizes, because of its obvious advantages, rapidly displaced arc lamps for interior store illumination; but in one respect it was inferior to the carbon arc lamp, namely, the color of the light. Therefore, when the nitrogen-filled lamp, with its more nearly white light came along, the store-owners were the first to put it into use. In fact, the insistent demands of the merchants for these lamps at first exceeded the limited supply, and there was a dearth of suitable fixtures that made proper provision for the unusual problems presented by the new lamps. The intrinsic brilliancy of these lamps is so excessively great, that means of reducing it and securing proper eye protection is necessary. The temperature of the lamp rises so very high that special types of sockets and fixture wire must be used, and proper ventilation of the fixture provided, in order to eliminate fire risks.

Undoubtedly this demand for white light spurred on both the lamp, reflector and fixture manufacturers, so that in a comparatively short time, lamps in quantity and suitable fixtures could be obtained. It is quite interesting to consider why the light of the nitrogen lamps is so superior to that of the vacuum lamps.

White light is a mixture of all the colors of the spectrum; red, orange, yellow, green, blue and violet. All of these colors, and intermediate shades, are present in daylight, and hence when we look at a piece of purple goods, we see it as a purple; or, when we look at a blue object, it is blue. The light from the carbon and vacuum tungsten lamps is deficient in the green, blue and violet light rays and for this reason is yellowish in character, being more so in the case of the carbon, than in the case of the tungsten lamp. Hence, when we look at a piece of blue goods under either of these, it does not appear blue. We mistake it for black, because

* Illuminating Engineer, National X-Ray Reflector Co.



Splendid illumination effect using indirect units in retail shoe store—Night photograph without use of any auxiliary light whatever

there is not sufficient blue light present in the lighting to make the blue color of the goods visible to the eye.

The light from the new nitrogen lamps contains a much larger quantity of blue, green and violet light than either the carbon or tungsten lamps, and consequently gives more nearly white light. Hence, when we look at a green or blue piece of goods, there is sufficient of these colors present in the lighting to make the goods appear as a green or blue. In addition to this, the nitrogen lamp gives a great deal more light per watt of electrical energy, than the tungsten lamp. The lamp is made in sizes as large as 1,000 watts, and in this size has the efficiency of .60 watts per candle power. In the smaller sizes, 100, 200 and 300 watts, it is considerably less efficient, but the color of the light is good.

As previously mentioned, however, these lamps have the serious drawback of being too intensely brilliant to be used like ordinary lamps. They are veritable "balls of fire" and their merciless glare is very harmful to the eyes. So generally is this fact recognized that the city of Chicago has passed a regulation requiring all gas-filled lamps to be properly shaded, to reduce the intensity of the light so that it will not be injurious to the eyes. If a customer is subjected to this intense glare, it will be very difficult for him to see the merchandise offered for sale. Consequently fixtures must be designed especially to protect the eyes from the direct rays of the lamp. The most effective method of doing this, of course, is to completely conceal the brilliant filament within an opaque reflector, as with the indirect system. The cheapness of light production with these lamps, makes the lower

Fig. 2

efficiency of the indirect system of no consequence, and the uniform and diffuse illumination that fills the entire store, similarly to daylight, cannot be equalled by any other method. With the indirect system also, a few large wattage, higher efficiency lamps may be used, whereas with other forms of lighting, only the smaller, lower efficiency sizes of lamps can be considered at all, and therefore more outlets must be provided, which adds to the wiring cost.

In Fig. 1 is shown a shoe store lighted with special indirect fixtures for gas-filled lamps. This is a remarkably well illuminated interior. One can get a clear and unobstructed view from front to rear. Looking at the display in the front glass case, one would say there is additional local illumination. However, this is not the case, as can be ascertained by a closer inspection. The use of a contrasting background, however, is very effective in compelling attention to the merchandise. The two show-cases at the sides, of course, require special illumination, but it will be noted that here again the lights are concealed, which is in accord with

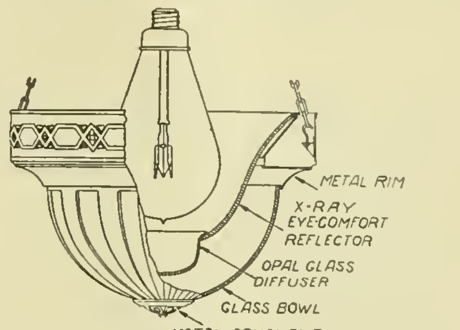


Fig. 3

the general scheme of lighting. Too many times, the indirect lighting effect is impaired by exposed show-case, bracket and window lights.

The interior construction of the fixture is shown in Fig. 2. The fixture is wired with asbestos covered wire, and the socket is porcelain. The open construction insures plenty of ventilation round the lamp and silvered glass reflector.

It is also possible to secure an illuminated bowl with indirect fixtures of this type, Fig. 3. An opal glass diffuser cup, resting in the bottom opening of the reflector, permits some light flux to pass through to the outer enveloping bowl. The amount of light flux utilized in this manner is approximately 3 per cent. of the total. The diffuser is designed with varying thickness of walls, so as to uniformly illuminate the outer glass bowl. A fixture of this kind, although luminous, can scarcely be called semi-indirect, since the transmitted light is so very low. The brightness of this bowl does not exceed that of the ceiling overhead, and the resultant illumination has all the advantages of truly indirect lighting. This type of fixture is very popular for stores, because many merchants feel that the decorative feature of luminous glassware is highly desirable in a store.

More Luminous Arcs for Westmount

The City of Westmount, P.Q., have decided to extend the system of magnetite arc lighting of the inverted type which was recently put into operation. Many of the old poles have already disappeared, and during the present year it is likely that practically the whole of the remainder will be done away with, and their place taken by artistic standards. It is intended to go ahead with the new lighting on St. Catherine Street and also on many of the side streets. On the former thoroughfare 6.6 ampere lights will be used and on the side streets 4 ampere lights. The contract for 53,000 feet of cable, chiefly of the twin conductor 7,500 v. steel tape armoured type, has been let to the Eugene F. Phillips Electrical Works, Montreal; the contract for the standards went to J. Watson & Son, Montreal, and that for lamps to the Canadian General Electric Company.

A. H. Winter Joyner, Limited, now have their offices and show rooms at 100 Wellington Street West, Toronto, where they have more convenient and commodious quarters than at the old 76 Bay Street location.

National Electrical Contractors' Association Universal Estimate Sheet.

NO. LIGHTS ______	Bid Goes to ______		
NO. SWITCHES ______	Address ______		
NO. CIRCUITS ______	Architect or Engineer ______		
NO. BASE PLUGS ______			
NO. TELEPHONES ______	Address Architect or Engineer ______		
NO. MOTORS ______	Name of Job or Building ______		ESTIMATE NO. ______
NO. FIXTURES ______	Location of Job or Building ______		SHEET NO. ______
H. P. MOTORS ______	See Mr. ______	Telephone No ______	DATE ______ 19 ______
K. W. GENERATOR ______			
SWITCHBOARD ______	Bid Must Be In by ______ M. ______	Salesman ______	JOB NO. ______

Material Estimated by	Labor Estimated by	Priced by	Approved by
______	______	______	______

REMINDERS	QUANTITY	DESCRIPTION	PRICE EACH	TOTAL COST	LABOR UNIT	TOTAL LABOR
Conduit, Rigid						
Conduit Elbows						
Conduit Bushings						
Conduit Straps						
Conduit Hangers						
Lock Nuts						
Conduit Flexible						
Conduit Fittings						
Conduit Non-Metal						
Ceiling Boxes						
Bracket Boxes						
Switch Boxes						
Floor Boxes						
Box Covers						
Fixture Hangers						
Cutout Cabinets						
Panelboards						
Metering Panels						
Meter Loops						
Cutout Boxes						
Asbestos						
Cut Out Blocks						
Fuse Plugs						
Enclosed Fuses						
Flush Switches						
D. P. Flush Switches						
3 Way Flush Switch						
4 Way Flush Switch						
Snap Switches						
D. P. Snap Switches						
3 Way Snap Switch						
4 Way Snap Switch						
Knife Switches						
Door Switches						
Pendant Switches						
Rubber Covered Wire						
Lead Covered Wire						
Fixture Wire						
Special Wire						
Lamp Cord						
Reinforced Cord						
Packing House Cord						
Show Window Cord						
Molding Wood						
Molding Metal						
Molding Fitting						
Fixtures						
Clusters						
Key Sockets						
Keyless Sockets						
Wall Sockets						
Rosettes						
Socket Bushings						
Cord Adjusters						
Shades						
Shadeholders						
Adapters						
Attachment Plugs						
Lamps, Incandescent						
Lamp Guards						
Arc Lamp						
Cleats						
Knobs						
Tubes						
Screws						
Nails						
Toggle Bolts						
Annunciators						
Annunciator Wire						
Annunciator Cable						
Elevator Cable						
Bells						
Buzzers						
Push Buttons						
Silk Cord						
Door Openers						
Burglar Alarm						
Batteries						
Bell Ringers						
Telephones						
Telephone Cable						
Speaking Tube						
Whistles						
Letter Boxes						
Tape						
Solder		TOTAL				
Compound		BID SENT TO FOLLOWING:	MATERIAL			
Acid						
Oil						
Car Fare			LABOR			
Cartage						
Bond						
Drafting						
Inspection			OVERHEAD EXPENSES Per cent			
Incidentals						
			PROFIT Per cent			
			BID			

FIG. 1—UNIVERSAL ESTIMATE SHEET OF NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION

Standard Estimating Sheets

No Contractor can be successful without some established system of estimating, comparing and filing

The average electrical contractor has difficulty in keeping tab on his business expenditures and receipts. He knows in a general way at the end of the season whether or not he has made a profit, but he often cannot place his finger on the profitable or unprofitable jobs, and still more rarely does he know the particular items of any job on which he has made an error in his estimations. This is a big handicap, if for no other reason than because it often happens that contracts are more or less duplicated from time to time, and unless a contractor knows whether his former figures were right, he cannot figure intelligently on a second similar job.

The most successful contractors know, as soon as a job is finished, just where errors in their estimates, if any, have crept in. This data is filed and not only saves valuable time in figuring on future work, but also acts as a very reliable guide for estimating on duplicate or similar buildings.

The National Electrical Contractors' Association of the United States has accomplished good work in standardizing form sheets for estimates and other data and recently have produced a new estimate sheet and proposal form which will undoubtedly prove very helpful to those who use them. The printed items on these sheets not only act as a reminder of the almost "thousand and one" little items of expenditure, some of which, under a less systematic scheme, will almost certainly be overlooked, but they allow of comparison between estimates and actual costs as determined later. The forms also include spaces for making memoranda of such personal data as the location of the building, name of owner, and so on, all of which is valuable information, especially in case of further requirements from the same party.

The secretary of the National association, Mr. G. H. Duffield, has very kindly supplied us with copies of both the estimate sheet and the uniform proposal form, and we reproduce them herewith. The estimate sheet measures approximately 16 ins. by 10 ins., and the proposal sheet 11 ins. by 8 ins. We understand these sheets are on sale by the secretary for a merely nominal sum. Under the heading "Outlets" in the proposal form, it will be noted that a number of columns are headed by abbreviated terms. These are explained on the reverse side of the form.

UNIFORM PROPOSAL

Estimate No.__________ ________________________19___.

To ____
(Owner)

Address____________________________

............................hereby propose to furnish all the labor and material necessary to do the Electrical Work in and about the premises located at........................ .... for the sum of.. Dollars

Payments therefor to be made by the Owner to the Contractor every thirty days after the beginning of the work, said payments to be at least......per cent of the value of all the labor and material installed, final payment to be made within........days after completion of contract.

The work done and the material furnished under this proposal to comply with all the City Ordinances governing this class of work and in accordance with the latest rules and requirements of the National Board of Fire Underwriters for the installation of Electric Wiring and Apparatus, and said work shall be of the amount and kind designated below.

The within proposal shall become a contract between the parties hereto when duplicate is signed and returned by the Owner to the Contractor within........days from date above shown, otherwise the within proposal shall be null and void.

All changes in this proposal to be made in writing and signed by both parties hereto, which said writing shall set out and contain in full the character, extent, cost and conditions of said changes.

Building	Conditions of Building	Class of Work	
Frame	Under Construction	Concealed	Rigid Conduit
Brick	Being Remodeled	Open	Flexible Conduit
Concrete	Completed	Knob and Tube	Armored Conductors
		Metal Moulding	

Extent of Work	Meter Location	Inspection
Roughed in		
Finished	....	....

(For explanation of terms and abbreviation see reverse side of this sheet.)

OUTLETS

ROOMS	LTS.	CEIL.	BKTS	F. R.	S P F	3 W F	S P S.	3 W. S	SPECIAL

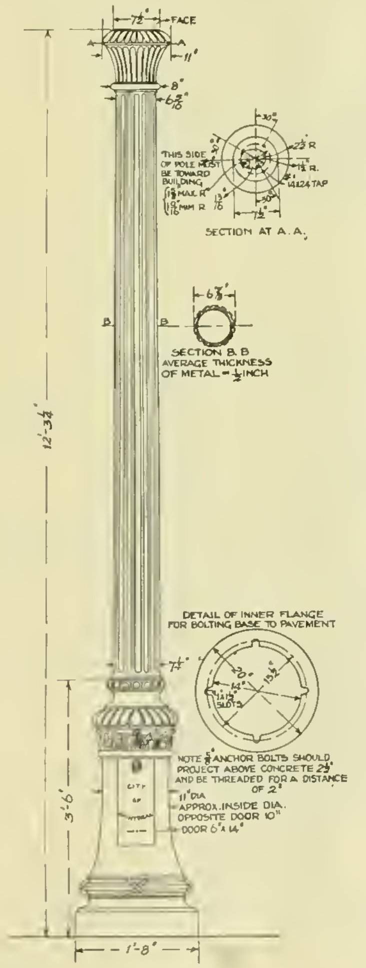
The above proposal is hereby accepted.

this......... day of.................. 19 ... Respectfully submitted

....
Owner Contractor.

Montreal Extending Lighting System

The City of Montreal have awarded the contracts for the new system of lighting on a portion of St. Catherine Street and on Bleury Street, which will result in the abolition of the present unsightly poles. The scheme provides for the installation of 84 6.6 luminous arc lamps of the inverted type, on ornamental poles of special design which will be spaced 125 feet apart. G. M. Gest, Limited, Montreal, obtained the contract for furnishing and installing the standards, for \$6,095; the Eugene F. Phillips Electrical Works, Limited, Montreal, the cables and wiring, for \$21,211; and the Canadian General Electric, the lamps, for \$10,657. The electrical portion of the work will be done by the Eugene F. Phillips Electrical Works, Limited, their contract price including the supply of about 56,000 feet No. 6 B & S twin conductor paper insulated lead-covered cable and the wiring, which will be No. 6 B & S single conductor varnish cambric insulated and braided; also the cut-offs and pot heads and lightning arresters. The work will be commenced early in May.



Ornamental Poles of Special Design for St. Catherine St. Montreal.

Hydro Issuing Notices

The Hydro-electric Power Commission of Ontario are issuing notices to contractors, supply companies, wiremen and others interested, in regard to the necessary observing of the Department's rules and regulations. It is pointed out (see advertisements elsewhere), that it is contrary to the laws of the province to install electric wiring in, upon or in connection with any building, unless the same complies with the requirements of the rules and regulations of the Commission. Permits must be secured before the work is commenced. Supply companies are notified that it is contrary to the law to make connection of supply current without a proper certificate therefor from the electrical inspector authorized to act in that district.

Special Issue of "The Electric Vehicle"

The Ward Motor Vehicle Company, of Mount Vernon, N.Y., have just received from the press a special issue of "The Electric Vehicle," (second edition), a handbook by Cushing and Smith. This edition has been issued for the special purpose of supplying a copy of the book with each "Ward Special" as it is delivered to the purchaser. The Ward Special has been placed on the market by this company in response to a demand for a high-grade vehicle at a low price ($875). The car includes such features as Timken axles, Westinghouse motors, Firestone tires, Philadelphia batteries, and so on. A special charging outfit has been designed for this vehicle. This car marks another step towards the production of an electric vehicle which the average man or woman can buy.

Century Increasing Capital

The Century Electric Company, St. Louis, Mo., have increased their capital stock to one million dollars, to enable them the more readily to take care of the increasing demand for their products.

P & S Publications

Pass & Seymour, Inc., Solvay, N.Y., have for distribution, four descriptive folders just off the press on the following material: P & S conduit box straps 1179 and 1180; P & S Mogul sockets and receptacles; P & S decorative material, and a folder on the P & S candle socket. These folders are full of just the information the practical wireman or electrical user has time to read.

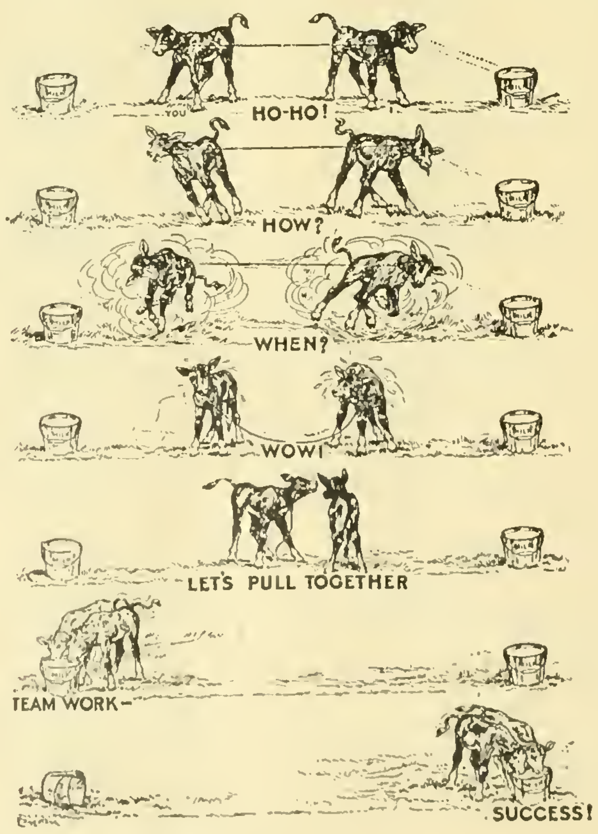
Personal

Mr. Wm. Parker, formerly inspector of the Hamilton Street Railway Company, has been made superintendent, succeeding Mr. J. Pearson.

Obituary

Mr. H. J. Somerset, the engineer chosen by the Hydro-electric Power Commission of Ontario to organize and superintend the reconstruction and operation of the London & Port Stanley Railway System, died recently in Toronto from pneumonia. Mr. Somerset was formerly manager of the Winnipeg Electric Railway Company, and later, for several years, in control of the Perth, Australia, Electric Railway System. He had only recently returned to Canada and associated himself with the Ontario Commission.

Mr. J. A. Culverwell, a well-known figure in civil and electrical circles in the Trent Valley district, died in Toronto on April 21st. Mr. Culverwell some years ago showed his faith in the future of the Trent Valley as a power centre, and as managing director of the Central Ontario Power Company acquired a number of water power sites on the Trent River and in that vicinity. These have later proved to be exceedingly valuable. In 1906, in the same connection, Mr. Culverwell organized the Northumberland and Durham Power Company and became its president. This company was later absorbed by the Electric Power Company. Mr. Culverwell was a life member of the Engineers' Club of Toronto.



Courtesy Armour & Company.

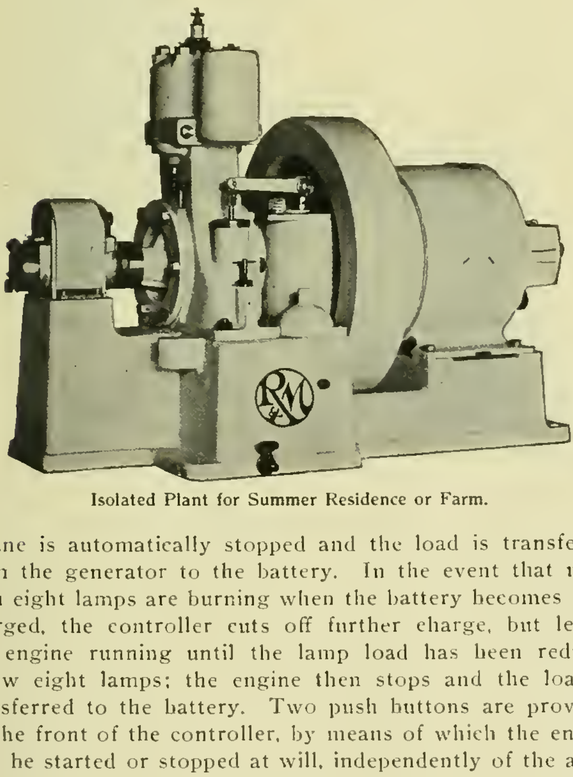
Mr. Electrical Contractor,—

Is there anything about this picture that reminds you of the Electrical Contracting business in your town? There is enough "milk" to go round, yet the first three "acts" plainly indicate that they were both determined that the other should not have any. Then came the decision to co-operate. How about Electrical Contractors? Are we "pulling together" or are we deliberately spilling our own and the other fellow's "milk"? Study the last three stages of this cartoon — that's co-operation.

What's New in Electrical Apparatus

New Small Isolated Plant Lighting Unit

A new lighting unit manufactured by the Okey Manufacturing Company, Columbus, Ohio, and shown herewith, has several novel features. The engine is a special design this company has developed for lighting service, and is not sold except with the dynamo direct connected as shown. The outfit is made in two styles. The first, known as type "F," is equipped for furnishing current direct to the line with no storage battery auxiliary. This outfit is for service where a certain number of lamps are burned through the entire night, or when current is required at stated hours only, during which period the engine is operated. The second outfit, known as type "FB," has an auxiliary storage battery so current can be had at any time whether or not the engine is running. A load equivalent to eight 16 candle-power lamps will operate off the battery without starting the engine. As soon as one more lamp is turned on, however, the engine is automatically started, the generator acting as a motor with the battery supplying current until the engine is started. After the engine has started it will continue to operate, even though all the lamps are turned off at once, until the battery is completely charged. Then the

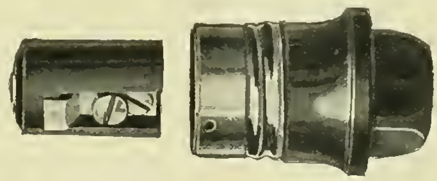


Isolated Plant for Summer Residence or Farm.

engine is automatically stopped and the load is transferred from the generator to the battery. In the event that more than eight lamps are burning when the battery becomes fully charged, the controller cuts off further charge, but leaves the engine running until the lamp load has been reduced below eight lamps; the engine then stops and the load is transferred to the battery. Two push buttons are provided on the front of the controller, by means of which the engine may be started or stopped at will, independently of the automatic controller. The controller also is so constructed that it automatically gives the battery a so-called "over-charge" at every twelfth charge. The engine is the single-cylinder, two-stroke cycle type. Excellent regulation is obtained by a throttling-governor which holds the speed within 1½ per cent. above or below normal. The governing mechanism operates in an oil bath. A Bosch high tension magneto furnishes the current for ignition. It is driven through a noiseless flexible coupling directly from the engine shaft. The generator is made by The Robbins & Myers Company, Springfield, Ohio. The type "F" sets are wound for 115 volts and those for type "FB" are wound for 42 volts to operate with the 32 volt battery system. The generators for both types are compound wound to give flat voltage regulation at all loads. The generator is mounted in line with the engine and directly connected to the engine shaft. The complete equipment of the type "F" outfit consists of engine with direct connected generator, 24-gallon tank for cooling water, 10-gallon tank for gasoline, hose for water connection, hose clamps, copper tube for gasoline connection, muffler, extra spark plug and set of tools. The type "FB" outfit in addition to the above has a 16-cell Hyray exide battery, two counter cells Hyray exide battery and controller panel of black slate with all instruments supported with angle iron supports.

The "Arroplug"

Here is an attachment plug made on a new principle. It has a spring plunger and a short screw thread, so that a push and a single turn are sufficient to make contact and lock the plug securely. The circuit is made or broken instantly. The "arroplug" is the most convenient plug for use in confined spaces, and it is especially convenient for use with vacuum cleaners, heating devices, etc., as it can be attached and detached instantly. The interior is removed for wiring



by depressing a small flat spring with a screw driver or similar instrument. After wiring, the interior is slipped back into the shell and locks automatically. The insulating material is "Thermoplax," and will not burn or soften under temperature of 600 deg. Fahrenheit. As its name implies this device is manufactured by the Arrow Electric Company, Hartford, Conn.

"Universal" Push Button

The Garford Manufacturing Company, Elyria, O., is offering the new "Universal" push button shown herewith. The entire top is movable, insuring good contact regardless of the point at which pressure is applied. The button shell

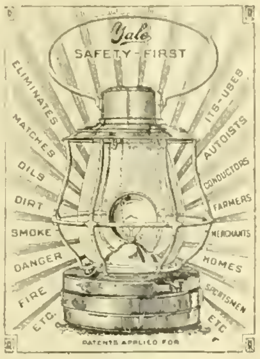
is furnished in black enamel, the top being made of a black composition. It is especially adapted for operating motor car electric horns.

New Books

Direct-Acting Steam Pumps.—By Frank F. Nickel, associate in mechanical engineering, Columbia University; McGraw-Hill Company, Inc., New York, publishers. Price, $3.00. A history of the development and performance of the direct-acting pump, gained through an experience of the author extending over thirty years of operation.

Yale Electric Lantern

The electric lantern shown herewith is shaped like an ordinary kerosene lantern and is equipped with a standard No. 1 chimney. The height of the device is 9 ins., width 6 ins., weight without battery 1 1-3 lbs. and with battery 2¼ lbs. The metal parts are of brass and steel and are heavily nickel-



plated. Use is made of a 3.8 volt tungsten lamp, which is operated by a three-cell battery. The space occupied by the battery is 1.25 ins. by 3 ins. by 4 ins., and the battery will give fourteen to sixteen hours' intermittent service. The lantern is equipped with a search-lamp reflector as shown. The contact lever is conveniently placed at the side of the base. The cage and reflector are removable so that the lamp can be used for other purposes besides that for which it is primarily designed. The bottom of the lantern is made of one-piece drawn metal and is waterproof. It is fastened to the top by three bayonet-lock connectors. The chimney can be removed from the top. The connectors are reinforced with rivets or special metal fastenings to insure strength. The "Yale" electric lantern, as it is called, is being made by the Yale Manufacturing Company, 24-30 South Clinton Street, Chicago, Ill.

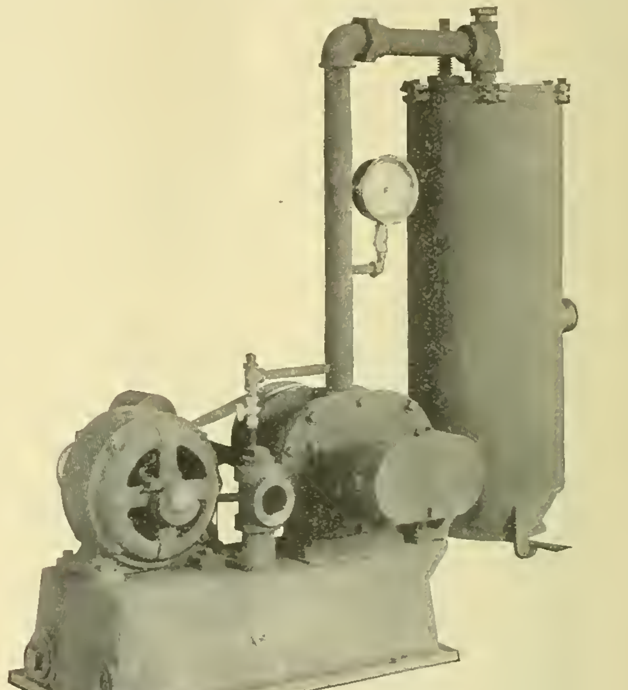
New Open Element Range

The National Electric Heating Company, Toronto, have just placed on the market their new open element range, which we illustrate herewith. As seen in the illustration, there are four units to the stove proper, which have a maximum consumption of 1,200, 1,000, 660 and 660 watts respectively. Each of these units is wired for three heats, medium

being half and low one-quarter of the maximum consumption. The oven, which is of medium height, contains two elements of 1,000 watts consumption each, the oven unit at the bottom and the broiler at the top. The range is splendidly manufactured and finished throughout.

Atwood Vacuum Cleaner

It is not many years since the real economic value of the vacuum cleaner as an agent of sanitation and a labor saver was first recognized. Since its introduction it has been developed and commercialized to such a remarkable degree that it is now regarded almost universally as a household necessity. The cleaner shown in the illustration is suitable for the average residence or apartment. It represents the latest development of the Atwood Vacuum Cleaner Company, and, while embodying many improvements, the principle of operation is the same as that of the Atwood cleaners which have been on the market for several years. The vacuum is obtained by a motor-driven exhauster operating on the principle of the two-shaft positive blower. It consists of two shafts, each carrying an impeller similar to a two-toothed gear. These impellers turn in opposite directions and operate with a very slight clearance on all sides which is sealed by water drawn from and afterwards re-



turned to a reservoir in the base. The bearings have unusually large wearing surfaces. The two bearings on each side are set in a large oil chamber which permits easy inspection upon lifting a hinged cover. A Westinghouse electric motor is belted to the exhauster. The one shown in the illustration is a one-half horsepower, alternating current, and is fitted with a clutch similar to the multiple-disc type used on many well-known automobiles. An ingenious combination of a tank and a canvas bag insures the removal from the air of all dirt. The air passes first into a tank where the larger particles are removed by gravity and then through a canvas bag which removes the finest dust. After passing through the exhauster, the air is discharged through a pipe which can be connected to a pipe running to the outside of the building or into a chimney. This is important from the standpoint of sanitation, as all disease germs are thus carried to the outside of the building instead of being allowed to escape back into the room.

Captain E. A. Ablett, general manager of the Siemens Company of Canada, Limited, Montreal, has left for England, with the object of joining the British forces at the front. The Siemens branches throughout the world have contributed a large number of volunteers to the Imperial army and navy forces.

Subway Type Oil Fuse Cutouts for High-Tension Work

The success that has been experienced in service with pole type oil fuse cutouts, together with the increasing demand for a thoroughly reliable, high grade protective device for subway service, has warranted the D. & W. Fuse Company in designing a primary oil fuse cutout for this work. In the essential principles these cutouts are identical with their pole

Fig. 1.

type. Some modifications have necessarily been made to adapt them for the different class of service in which they are to be used. The principal changes have been the substitution of a lead gasket for the compressible gasket employed in the pole type cutout, different provision for venting the cutout and protecting it against the possibility of water entering through the vent openings, and a radically new method of arranging for connection with the cables in the two and three pole types. These cutouts are made in 50, 100 and 200 ampere capacities, single pole, and in 50 and 100 ampere capacities, double and triple pole, 2,500 volts. The illustration, Fig. 1, shows the three pole type.

In order to effectively compress the lead gasket against

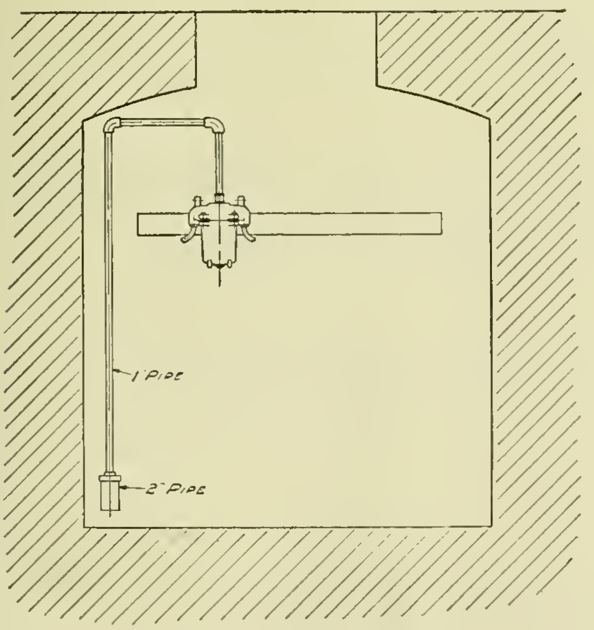


Fig. 2.

the V-shaped ring on which it rests, a swivelling yoke is employed carrying at its centre a powerful compression screw provided with a lock nut; a quarter or half turn of this brings the gasket against the V ring with such force as to insure the absolute tightness of the joint, even where the cutout is entirely submerged. The gasket in the carrier head, which might become unduly distorted owing to the repeated openings of the cutout, is so arranged as to be readily renewed at very slight cost, thus insuring continued tightness of the cutout under service conditions.

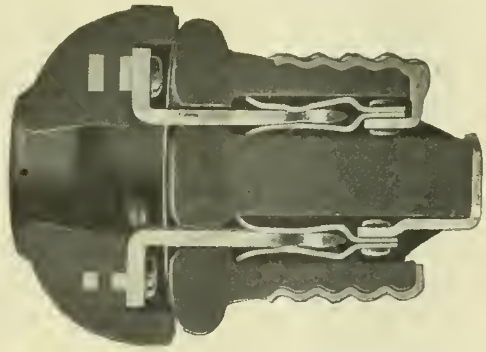
A similar form of lead gasket is used between the oil container and the top of the cutout. In this case a suitable number of clamping bolts provide the necessary compression to draw the oil container into position and to insure tightness of the gasket.

The venting arrangement necessarily had to be completely modified for subway service and provision is made for connecting the cutouts to a common venting pipe. This pipe, preferably, is carried to the highest point within the manhole and from that dropped to within five or six inches of the floor; the lower end being enlarged a few inches to the size of a pipe at least twice the diameter of the original. Should water flood the manhole, the air is compressed in the cutout as it rises and absolutely prevents the admission of any water, even should the manhole be completely filled. At the same time, any undue pressure within the cutout itself, resulting from the blowing of a fuse, is promptly relieved as the pipe would only be sealed by the water at its lower end. The diagram in Fig. 2 illustrates this method of venting.

The general design of the fuse carrier is identical with that used in the pole type cutout; the locking arrangement being the same so that the carrier is locked into position before contact is made with the terminals. The fusible element is placed under a heavy body of special oil. On the blowing of the fuse the terminals are so arranged that they are forcibly thrown apart and the oil being interposed between them, effectually prevents the formation of an arc.

New Hubbell Plug

We illustrate herewith Hubbell 5815 plug cut open to show the new style of contacts. These contacts are deeply embedded in narrow slots, eliminating the possibility of



short-circuiting, accidental shock or arcing. The entire line of interchangeable attachment plugs and flush receptacles are equipped with this type of contacts.

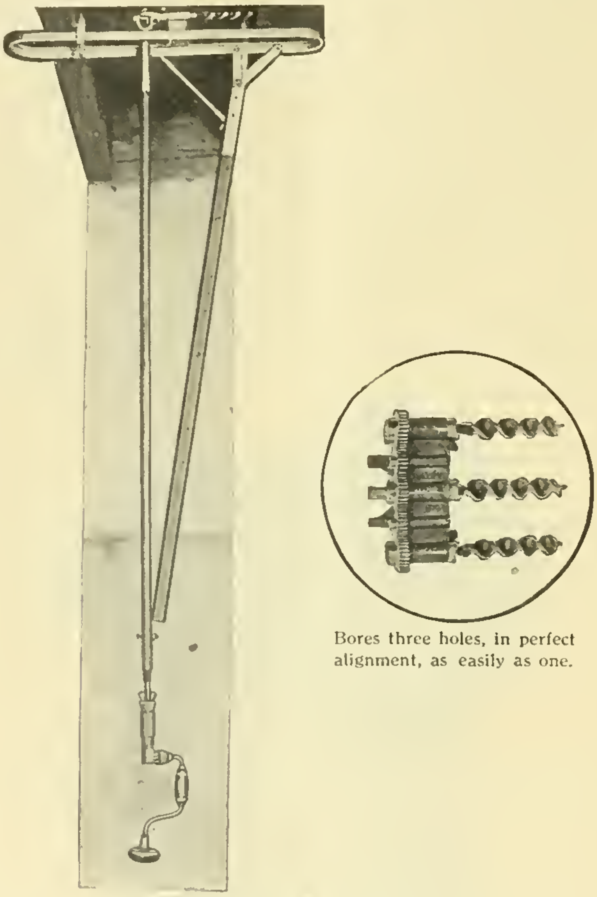
Good "British Insulated" Report

A very satisfactory report was presented at the annual meeting of the British Insulated and Helsby Cables, Limited —of which the Canadian British Insulated Company, Limited, Montreal, is a subsidiary—recently held in Liverpool, England. The profit for 1914 was £277,428, an increase of £30,077, the total being the largest in the history of the company. Dr. E. K. Muspratt, the chairman, stated that the extra profits were not due to orders for war supplies. Work had been done for the War Office and the Admiralty, but the total was not large enough to materially affect the earnings as a whole. While the war had affected business with many of their best customers, the company had done a much larger trade than before the war with neutral countries. The general result had been that the company's factories had been very busy throughout the whole of the year, and the unexecuted orders

in hand at the present time were more than ever before. A considerable number of the company's staff had joined the forces, and both they and their dependents had been liberally dealt with by the board. The staff and workpeople had also on their part, by voluntary weekly subscription, contributed to relief funds to the extent of over £1,000. The company was now paying a war bonus to its employees to meet the enhanced cost of living. Having regard to the good results of the year's trading the directors had felt justified in setting aside £25,000 towards the formation of a pension fund, which had been under consideration for several years past. The chairman concluded by stating that they were executing a contract for the Australian Government amounting to about £600,000.

The Turgor Borer

Contractors will be interested in a novel boring tool which has just been put on the market by the Turgor Borer Company, 580 Bay Street, Stapleton, N.Y., and illustrated herewith. By means of this tool holes can be easily and quickly bored in awkward places that have heretofore had



Bores three holes, in perfect alignment, as easily as one.

to be tackled by means of a step-ladder and ratchet brace. As shown in the cut these holes can be bored one, two or three at a time. It clamps in place in a few seconds and bores straight through the beams, there being no zig-zag holes due to faulty driving. The man puts all his weight behind the brace and can bore through beams of a 12-foot high room without leaving the floor.

Optimistic on British Trade Outlook

Mr. Lawford Grant, sales manager of the Eugene F. Phillips Electrical Works, Limited, Montreal, who recently returned from a five months' visit to Great Britain, talks in a very optimistic strain of the business situation in the Old Country. Mr. Grant visited a large number of the principal cities, and made extensive observations as to the general outlook. He states that there is a great lack of help in nearly all industries, and that men are working night and day on Government and private orders. With regard to the electrical and wire and cable trades, the factories are so abundantly supplied with business that in most cases the companies are unable to touch foreign orders. In some instances, help is so scarce that the Government has placed what amounts to an embargo on men joining the forces unless with the consent of the firms concerned. Great Britain is supplying Russia, France, and Belgium with guns, ammunition, electrical goods, etc., and British firms are perforce extending their plants to meet with the demands. This involves the purchase of a large amount of electrical machinery, and the extensive buying, combined with the War Office and Admiralty orders, is keeping the electrical industry at full pressure. In Mr. Grant's opinion, the end of the war will witness a tremendous boom in Great Britain.

London Street Earnings

The gross earnings of the London Street Railway Company for the year ended December 31, 1914, were $375,895, an increase of $43,928 over 1913. Of this increase $43,839 came from passenger traffic. This increase was mostly caused by the first year's operation of Sunday service, although the gross earnings made a satisfactory gain even without Sunday earnings. The total operating expenses for 1914 amounted to $267,901, an increase of $32,984. Cost of power for transportation showed a decrease of $3,701 for the year, but the remaining expense items showed increases, as follows: way and structures, $5,193; equipment, $4,363; car service, $23,979, and general $3,150. The net earnings increased by $10,944 to $107,994, while interest deductions increased $2,835, giving net income of $76,045, an increase of $8,109. During 1914 the company expended $47,912 in construction and equipment. The total revenue passengers carried in 1914 were 10,286,448, as compared to 9,078,489 in 1913, and the transfers in the two years were 1,697,963 and 1,462,562. The net earnings per car mile decreased from 6.13 cents in 1913 to 5.66 cents in 1914.

The Triple Tread Manufacturing Company, Limited, Winnipeg, have been awarded a contract to supply storage batteries to the Winnipeg Municipal Electric System.

(Concluded from page 29)

tributing his or her order over several departments, and the incident trouble and loss of time which would arise in obtaining connection with the different departments handling the articles desired.

Each elevator has a telephone connecting to a master station in the engine room, this being a complete system in itself. The engineer can call any operator, but the elevator operator can only obtain connection with the engine room master station. A separate intercommunicating system is made up of telephones located at the openings of the dumbwaiters on the various floors.

All the low-tension systems, with the exception of the telephones, are operated from a small storage battery. This battery is installed in duplicate and is charged by means of small motor generator sets, also in duplicate. A small switchboard harmonizing with the main board in style and material has switches for the two motor-generaors and for the various systems mounted upon it; it also carries a voltmeter and ammeter and the field rheostats for the motor generators.

The store and its equipment is one of which Vancouver is justly proud. The architects were Burke, Horwood & White, of Toronto; Percival Robert Moses, of New York City, was the consulting engineer, and the shop fixtures were designed by Taussig & Flesch, of Chicago.

Current News and Notes

Blenheim, Ont.

A by-law will be submitted on May 10th, authorizing the council to expend $14,000 in installing a hydro distribution system and connecting it up with the Hydro-electric Power Commission's lines.

Chatham, Ont.

The work of installing ornamental lighting standards on King Street is well under way and should be completed in a couple of weeks.

Dominion, N.S.

The contract for light and power supply has been renewed with the Cape Breton Electric Company for a further term of five years at a rate of 6 cents per kw.h.,—a reduction of one cent. It has been announced by the local council that reduction to consumers will be made from 13 cents to 10 cents.

Galt, Ont.

Mr. W. H. D. Browne has been elected a member of the local Hydro-electric Power Commission, succeeding Dr. W. S. Dakin, who has been elected first deputy reeve.

Hamilton, Ont.

A further cut of 10 or 12 per cent. has been made in the Hamilton hydro rates.

Joliette, Que.

Work will be started in the near future on the installation of a lighting system to cost some $6,000.

Montreal, Que.

The Marks Electric Company has registered in Montreal, P.Q.; Mrs. Sam. Marks, proprietor.

The Shawinigan Electro-Metals Company, Limited, has been incorporated with a capital of $50,000. Shawinigan Water and Power interests are identified with the company, Mr. Howard Murray, Mr. W. A. Hart, and Mr. Julian C. Smith being incorporators; Dr. A. Stansfield, of McGill University, is also an incorporator. The purpose of the company for the present is to carry out at Shawinigan Falls, further experiments for the reduction of metals by electricity. Dr. Stansfield has already done a large amount of work in this direction at McGill University. He is at present on a visit to Vancouver, B.C.

Having completed the necessary financial arrangements in New York, Laurentide, Limited, paper manufacturers, of Grand'Mere, P.Q., will resume construction work on the 90,000 horse power hydro-development at their plant. A considerable amount of work was done when operations were suspended in the fall by the H. E. Talbott Company. A portion of the additional power will be utilized by Laurentide, Limited, and the remainder sold.

Nelson, B.C.

The service of the British Columbia Telephone Company has again been criticized by members of the Nelson Board of Control and the desire expressed for a municipal system.

Orillia, Ont.

Following a reduction in rates, the light receipts of the town for March, 1915, show a falling off of some $650 as compared with the same month last year.

Petrolia, Ont.

The Hydro-electric Power Commission of Ontario are taking an inventory of the property of the Petrolia Electric Light Company, with a view to this system being taken over by the municipality.

Ridgetown, Ont.

The town council will submit a by-law authorizing them to enter into an agreement with the Hydro-electric Power Commission of Ontario for a supply of current for light and power.

Rodney, Ont.

The village council have decided to secure estimates from the Hydro-electric Power Commission of Ontario on the cost of installing a distribution lighting system.

St. Catharines, Ont.

Niagara power was turned on in Grantham Township, Lincoln County, on March 15th.

St. George, Ont.

A by-law will be submitted on May 3rd, authorizing the council to enter into an agreement with the Hydro-electric Power Commission of Ontario, for a supply of power.

St. Marys, Ont.

The Medina Telephone Company contemplates certain extensions to their telephone system during the early summer.

St. Thomas, Ont.

The new ornamental street lighting system on Talbot Street was officially turned on on the evening of April 20th by Sir Adam Beck, chairman of the Hydro-electric Power Commission of Ontario. Sir Adam addressed the citizens briefly from the balcony of the City Hall and the proceedings concluded with a banquet at the Grand Central Hotel.

Toronto, Ont.

The Hydro-electric Power Commission of Ontario have awarded a large contract to the Packard Electric Company for the supply of various sizes of meters.

The following firms have recently obtained charters: The Canadian Electric Time Switch Company, Limited, and the Universal Electric Company, Limited.

The Chamberlain & Hookham Meter Company have been awarded a large contract for the supply of various types of meter to the Hydro-electric Power Commission of Ontario.

Vancouver, B.C.

The Western Canada Power Company are asking the shareholders to authorize an increase in the capital stock from five to ten million dollars and the creation of five million dollars 7 per cent. cumulative preferred stock. The annual report states that work on the third unit has been delayed on account of financial conditions existing during the past year. The gross earnings of the company for the twelve months of 1914 amounted to $318,800. Operating expenses were $87,149, leaving just sufficient to meet the interest on the first mortgage bond.

Winnipeg, Man.

Press reports state that passengers carried by the Winnipeg Electric Railway Company number at the rate of approximately three quarters of a million a month less than for the corresponding period a year ago.

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Generation Transmission and Application of Electricity

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Trunk Line Electrifications

Unusually interesting developments are promised in the near future in the realm of high voltage electrified steam railways. In Canada at two points construction is nearing completion—in one case of a 1,500 volt system and in the other at 2,400 volts. Another 2,400 volt electrification is planned and contracts let, and will presumably be proceeded with as soon as the financial situation shall have cleared up.

The first 1,500 volt line in Canada will be that of the London & Port Stanley Railway, which is the nucleus of a large system of hydro radials with which our Commission promise to cover the Province of Ontario. After the most searching consideration it has been decided that construction and operating costs justify the use of this higher voltage in preference to the time honored 600 or 650 volts, which at the present time is universal throughout the Dominion of Canada. Our first 2,400 volt line is nearing completion in Montreal and will probably be in operation within the next three months. The locomotives are practically ready for shipment on both these roads. The third electrifiction, which is temporarily held up, is a section of the Canadian Pacific Railway line over and through the Rocky Mountains where the heavy grades and a long tunnel will make this form of traction particularly attractive and economical.

At the time these electrifications were decided upon 2,400 volts d.c. was the highest at which direct current electrification had been attempted, but it is typical of the rapid changes that are everywhere taking place in electrical science that a 3,000 volt d.c. system has since been placed under contract on a United States Rocky Mountain road. There is no radical difference involved, however, in this increase in voltage which has been determined rather by the very heavy freight load to be taken care of in the particular case under consideration. The grades and tunnels of the Rocky Mountains are the special enemies of the steam engine and it is under such difficulties that electrification makes the best comparison. On the Pacific Coast line where the 3,000 volt equipment will be installed there are several tunnels—one of which is 9,000 feet in length. The maximum grade westbound is 2% over a distance of approximately 21 miles and eastbound 1.7 per cent. over 24 miles. One of the most difficult problems is a 1 per cent. grade practically continuous for 44 miles. It is understood, however, that the engineering difficulties have so far been overcome that the heaviest trains will make this grade at a 16-mile rate, without any undue strain on the motors. An interesting feature of this line (Chicago, Milwaukee & St. Paul) is the use of regenerative braking which will be adopted. The development of a satisfactory central system which will permit of this braking without undue complication, is a notable engineering achievement. Another noticeable fact in this electrification is that it was decided upon not so much because of local conditions as because it was shown beyond question that lower operating costs could be obtained than with steam locomotives. A considerable relief can of course also be had from congested freight or other traffic conditions. It is futher interesting to note that though this railway company originally intended to defer the electrification of the second division of their line until actual experience had been obtained through the operation of their first division they are so thoroughly convinced of the ultimate results that they have already placed orders for a second section of the electrification. This will now include 21-260 ton locomotives, 7 sub-stations with a total capacity in motor-generator sets of 29,000 kw. with a momentary capacity of 300 per cent. normal load.

In the City of Chicago the question of terminal electrification is also being considered in all its aspects. This work would involve a tremendous expenditure and is receiving correspondingly careful engineering study. Though there are, of course, special local conditions to be considered in this case the ultimate decision of the committee having this matter in charge, will have a very direct bearing on the course which many other large cities on this continent may safely follow.

The Public's Interest in the Jitney

One of the most important questions to be considered in connection with the jitney is whether, having usurped the field of the standard electric railway system, it is in a position to fill the needs of the public as an efficient means of transportation better than the electric railways are doing at the present time.

This is a question for the public even more than for the operators and shareholders of our electric railway systems. There is no doubt that the earnings of our electric railways are being materially reduced. In certain cases permission has already been given for a reduction in the number of cars operated on certain lines. At best competition from the jitneys will mean that additions to rolling stock which otherwise ought to be and, in the natural course of events, would be made, will now be delayed. Suppose, then, that in the course of three or six months, as the case may be, the owners of these jitneys should find the enterprise an unprofitable one. What condition or mood are our transportation companies going to be in, and what condition will the general public be in, when they are forced to fall back on the now despised and rejected electric cars?

It is, of course, useless to expect the average citizen to

consider these matters and look ahead a few weeks or months, even where the matter interests him so vitally as it appears to in this case. It should not be too much to expect of our city councils, however, that they should take the matter in hand and so regulate the operation of this mushroom growth that the legitimate field of our established railway systems should not be encroached upon.

This is a consideration quite aside from the fact that in a city like Toronto, the taxpayers are poorer to the extent of 20 per cent. of the reduction in the gross earnings of the Toronto Railway Company, which percentage amounted last year to a sum closely approximating $1,000,000. It would almost appear as if personal antagonism toward private corporations in general is being allowed to stand in the way of an exercise of common sense or at least common justice, both to the general ratepayer and to the man who has invested his capital in good faith.

We have not yet heard of any man engaged in the jitney business, who has sat down and counted the cost of operating his cars. There are innumerable estimates, however, from the other side, showing that the income cannot possibly meet the daily expenses, with even a narrow margin, when taking into consideration the interest on capital cost and depreciation. For example, a committee of the Oakland, California, Chamber of Commerce, specially appointed to consider this question, gives some interesting information as to the results of its findings on the cost of operation of a Ford car. The expenses per mile are placed at follows:

Expenses Per Mile

1. Drivers' wages, clothing and gasoline	$0.0407
2. Lubricants	.0005
3. Tires	.0200
4. Washing, polishing and garage attendance	.0070
5. Running repairs and garage attendance	.0085
6. Materials for running and mechanical repairs	.0033
7. Body repairs, painting, upholstering, etc.	.0017
8. Rent	.0056
9. Light, heat, power and maintenance	.0014
10. Taximeters	.0020
11. Licenses	.0007
12. Injuries and damages	.0050
13. Office and supervising salaries	.0076
14. Advertising	.0111
	$0.1151

These figures are based on the assumption that 1,500 miles will be run annually by a car. With a greater mileage, certain of these items would be reduced. Items 1, 2, 3, 5, 6, 7 and 12, which amount together to about 8 cents per car mile, are fairly constant per car mile, but the other items are nearly independent of the distance covered. If a car made 25,000 miles instead of 15,000, the cost per mile would be about 2.1 cents, instead of 3.5, as shown in the above table, and the cost per car mile now becomes 10.1 cents instead of 11.5 cents. Eliminating advertising and rent of taximeters, which expenses the jitney operator will reduce to a minimum, the total becomes 9.3 cents per car mile. To this amount there should be added at least .8 cents per car mile for depreciation, so that, using these figures as a basis, a car should earn at least 10 cents per mile to pay expenses.

Whether the operation of jitneys is a paying proposition or not is a question of immediate interest to comparatively few. On the other hand, the question of whether their life will be only sufficient to disorganize our electric railway systems and cause untold ultimate inconvenience and discomfort to the millions of patrons of electric railways all over this continent is surely a question worthy of immediate and most careful consideration on the part of our authorities, who have it in their power to regulate these matters.

Power Resources of the Pacific

The Department of the Interior have just issued Water Resources, paper No. 8, being a report of the British Columbia Hydrographic Survey for the calendar year 1913, by R. G. Swan, A.M. Can. Soc. C.E., chief engineer. The work treats of three divisions of British Columbia, namely, the Coast division, the Kamloops division and the Kootenay boundary division, and describes briefly the water powers, developed and undeveloped, and the hydrographic data in connection with the streams and rivers in these divisions that has so far been collated by the department.

Little by little it is coming to be recognized that the water powers of British Columbia constitute a very tremendous asset of that province. Especially interesting is the information given with regard to the Coast division, where the water falls are much higher than in any other section of Canada. The Rocky Mountains account for many falls in the neighborhood of 2,000 ft. We print below a few interesting extracts from this report covering the water falls in the Coast district,—

Bridge River.—A head of 2,000 feet could be developed at Bridge River by driving a tunnel through the ridge separating it from Seton Lake. The water would be diverted into the tunnel from Bridge River and conveyed from the other portal by steel penstocks to the power-house situated on Seton Lake. A great amount of power could be developed here, but the cost of the tunnel would render a large initial development necessary. The Pacific Great Eastern Railway, which is being constructed along the north side of Seton Lake, would provide good transportation but extra precaution would have to be taken to prevent a washout by any leaks or breaks in the tunnel or penstocks. Special provision might have to be made for carrying the extra discharge from Seton Lake.

Chehalis River.—The plan of development on this stream includes a storage and intake dam near the lower end of Chehalis Lake, and a large concrete pipeline, some 10 miles in length, to an equalizing reservoir near the mouth of the river. The penstocks would lead from the reservoir to the power-house, and would give a head of about 400 feet. Chehalis Lake would give splendid storage. It might be possible to divert the flow of the west fork (Statlu Creek) into the lake or into the pipeline.

Chilliwack River.—Chilliwack River is quite a large stream, having a fall of about 2,000 feet between Chilliwack Lake and the Fraser River. At one time it was proposed to carry water from Chilliwack Lake to Jones Lake, but this scheme was abandoned owing to the heavy expense which would be involved, and also as it was found that Chilliwack Lake was not at a sufficiently high elevation above Jones Lake. Another proposal is to construct a tunnel from the Upper Chilliwack valley to the valley of the Fraser River. This plan is probably quite feasible, but sufficient surveys have not been made to develop all its features. On account of the great expense of the tunnel, it would be necessary to make a large initial development.

Jones Creek.—The Vancouver Power Company has been investigating Jones Creek as a possible source of power. The plan is to drive a tunnel through the ridge between Jones Lake and the Fraser valley. The tunnel would be 10,200 feet long. Steel penstocks, 6,000 feet in length, would lead from the portal to the power-house on the bank of the Fraser River. A dam near the outlet of the lake would provide considerable storage. Boulder Creek could easily be diverted into the lake. This plant would utilize the combined flow of Jones and Boulder Creeks, and would be fairly well regulated by the storage in Jones Lake, under a head of 1,800 feet.

Mesliloet (Indian) River and Tributaries.—The Westminster Power Company propose to develop power from the

Mesiloet River and tributaries, and have already made extension surveys. Splendid storage facilities are available in Norton, Young, and Ann Lakes; from the first named lake a head of 2,000 feet could be developed.

Raven (Rushton) Creek.—This is a small creek flowing into Pitt Lake. Rushton Lake is 700 feet above Pitt Lake and only 4,000 feet distant. About 1,000 feet from Pitt Lake there is a fall of 100 feet. Mr. E. J. Fader proposes to run a pipeline from the head of the falls to a power-house to be built near the mouth of the creek. The power is to be used for running a rock quarry and gravel screening plant, neither of which has been built as yet.

Silver Creek (near Hope).—It would be quite possible to develop power on Silver Creek which flows into the Fraser River, near Hope, though as yet no definite details of any such scheme have been worked out. There is a fall of 1,100 feet from Silver Lake to the Fraser, but it is pretty evenly distributed over a distance of 5 miles. A long flume line would be necessary to develop any considerable amount of power. Silver Lake might be used for storage as long as it did not damage the Pacific highway which is being built up the creek valley and along the lake.

Slollicum Creek.—This small stream discharges into an arm of Harrison Lake. It has a series of falls near the mouth, with a total drop of 2,000 feet in about half a mile.

Electrical Installation on Pitt River Bridge, B. C.

We are indebted to Mr. H. C. Chambers, Chief Electrician of the B. C. Division of the C. P. R., for the following account of the electrical installation on the Pitt River Swing Bridge.

The swing span on the Canadian Pacific Railway bridge at Pitt River, B.C., is operated by three 30 h.p., 550 volt Wagner enclosed type slip-ring motors; one is used to pull the wedges and release the fastenings on the bridge, and the other two execute the turning movement. A three-phase, 2200 volt line is run up to the bridge, where two 50 kw., 2200 volt primary, 600 volt secondary Westinghouse transformers reduce the line voltage to 550 volts. The 550 volt line is carried across the bridge supported on the spans to the swing span, where it is raised 80 feet above the water to cross the channel. The swing span has a swivel on a steel tower to allow the bridge to turn without moving the wires. In the control tower on the swing span are installed circuit breakers, controllers and resistance grids for each motor. The two controllers for the two 30 h.p. motors which do the turning, are connected in parallel so either controller can be used. The first movement made by the operator to turn the bridge is to pull a lever which unlocks the wedges, throws the Home signal to "Danger," mechanically, and the distance signal to "Danger" electrically. Pulling lever to unlock bridge trips a lever which has locked the circuit breakers open. This gives a double protection, as the operator cannot possibly get the power to move the bridge unless he first throws his signals to "Danger;" he then starts the wedge motor which pulls the wedges, and then the other two motors, which turn the bridge and clear the channels for boats.

For lighting the control tower and channels there is a one kw. Westinghouse transformer, 550 volt primary to 110 volt secondary. A white light is installed on each side of the channel as a guide to boats at night, also a red and green light on the top of swing span which shows red to the boat when the bridge is open. A light is located between the tracks at each end of swing span and at the end of the bridge, so as to line up bridge at night.

The Electric Distance Signal was made by the Union Switch & Signal Company, and is operated by 16 B.S.C.O. primary batteries. A small d.c. motor is geared to the semaphore board, and when the swing span is closed it effects a contact which makes circuit through the motor and causes the semaphore to raise. When the semaphore comes to rest the motor leads, which are connected to a drum, run off the contact, which brings motor to rest; at the same time it makes another contact on drum which energizes an electric brake and holds signal clear. As soon as the power goes off the magnet releases and sign goes to "Danger," which also occurs should power fail at any time.

The lamps on the swing span being subject to considerable vibration, we have a special clip to hold lamp from turning, and by using a low voltage of 12 volts, which gives a heavy filament, the lamps withstand the vibration satisfactorily. This voltage is obtained by using an auto transformer on the 110 volt circuit.

Planning Immense Developments

The Newfoundland Government propose to enter into an agreement with the Newfoundland Products Corporation, Limited, represented by Mr. T. L. Willson, of Woodstock, Ont., with which is associated the Reid-Newfoundland Company, under which the two concerns named will carry out works totalling, at first, $16,349,300. Of this $6,440,300 is represented by water power developments. The Government will lease for 99 years the water powers in and upon the Humber River and in and upon Junction Brook, with the right to divert and dam the same or any lake or water powers within the drainage area of the Humber River. Should the company, within 21 years, acquire any additional water powers within a distance of 40 miles of proposed factories at Bay of Islands, the provisions of the agreement will apply to the additional water powers. The company agree within two years to survey the Hamilton and Northwest Rivers in Labrador; if the company, within ten years, in addition to an expenditure of five million dollars at Bay of Islands, expend a like sum in Newfoundland in connection with the extension of its business in Newfoundland, the Government will grant the company a water power on the Hamilton River from the head of Lake Winocapau to the sea or a like water power on the Northwest River, Labrador, but this is conditional on the company expending, within five years, the further sum of ten million dollars in the development of the water power and its plant in Labrador. The company agrees to furnish up to 50,000 horse power in Labrador to all persons or companies operating within 100 miles of their power houses. Among the industries to be established at Bay of Islands is one for the manufacture of electrode carbons.

Electric Propulsion of Battleships

The electric propulsion of the new United States battleship "California," is an interesting feature of present-day development. The equipment is being supplied by the General Electric Company. The "California" is a 30,000-ton vessel and will be equipped with two 18,000 h.p., 2,200 r.p.m. turbo-generators and four induction type driving motors. All the engine room auxiliaries will be motor-driven, direct-current for operating these machines being taken from the exciters. The maximum speed of this ship will be 22 knots per hour. At 14 knots the turbines will develop 7,000 h.p., and at 22 knots, 36,000 h.p. 75 per cent. of the power generated by the turbines will be delivered to the electric generator, and there will be a further 8 per cent. loss in the electrical equipment. Estimates of the Brooklyn Navy Yard show that the use of electric drive saved $160,000 in the construction of the "California." The General Electric Company has figured recently on equipment for two Russian battleships of 70,000 and 90,000 h.p. rating, and on several large vessels for the United States Navy.

Electrotechnical Congress Postponed

The Secretary of the Canadian National Committee of the International Electrotechnical Commission, Mr. A. B. Lambe, Ottawa, writes that they have been officially notified from London that the congress of this Commission, which was to have been held in San Francisco some time this year, has been postponed, conditions in Europe rendering it impossible to follow out the original plans.

"The Most Satisfactory"

Canadians in general will be interested in the following extract from a letter just received by the Electrical News from a visitor recently returned from San Francisco.

"You may be glad to know that after having been in San Francisco for some little time my own opinion and also the opinion of all those interested, so far as I can learn, is, that the Water Power Exhibit is completely successful. The Canadian exhibit as a whole is beyond all doubt the most satisfactory on the grounds and great credit is due Mr. William Hutchinson, Chief Exhibition Commissioner."

Underground 23,000-Volt Transmission

The Toledo Railways & Light Company recently put into successful operation a 23,000 volt, three-phase underground transmission system for supplying 12,000 kw. to the Willys-Overland automobile factory at Toledo. Five thousand kilowatts of the total sub-station rating is already installed and in operation, and an order has been placed for three more 1,000 kw. transformers to be installed at the Willys-Overland sub-station. It is planned, furthermore, that within six months another 3,000 kw. shall be added, which will complete the 11,000 kw. station as planned six months ago.

Canada Electric Company

In the report of the Maritime Coal, Railway and Power Company, it is stated that the installation of the electrical coal equipment at Joggins colliery was proceeded with during the year, and the results were apparent in more economical working. No new work had been done at the main power house at Chignecto, the enlargement of the generating plant having been completed at the close of last year. Unfortunately just about that time the demand for power began to fall off, in consequence of abnormal trade conditions affecting the Canada Electric Company's largest power users, and to such an extent that the revenue from this source was seriously reduced so that the result of the operations of the electric company for the ten months ending December 31st last was a deficit of $24,420.98. The directors, however, anticipate clearing this deficit on the return of normal trade conditions.

National Electrical Safety Code

The Bureau of Standards, Washington, is distributing for criticism three sections of their proposed National Electrical Safety Code; also a second edition of circular No. 49, which will constitute a fourth section of the proposed code. Criticisms will be received up to the time of the next conference, which will be held on July 1st and 2nd.

This electrical safety code will parallel in great measure the National Electrical Code, though it appears to be the general desire to keep the safety rules and the fire protection rules as distinct as possible. An understanding to this effect has been reached between the representatives of the Bureau of Standards and of the National Fire Protection Association, under which the latter association will co-operate with the Bureau, but will not assume any of the responsibility.

Any constructive criticism of the proposed rules and suggestions is invited, either in the way of changes or additions. Part 1 has reference to "stations and station equipment"; part 2, to "transmission lines," both overhead and underground; part 3, to the "utilization" of electric current, and part 4, to the "operation" of electrical equipment and lines.

Latest Hydro Report

The Hydro-electric Power Commission of the province of Ontario have issued their seventh annual report, covering operations for the year ending October 31st, 1914. The report shows that the total transformer capacity for the whole system is now 193,840 kv.a. Of this amount the Niagara step-up station covers 80,500 kv.a., 56,000 of which is 110,000 volt, and 24,000 is 46,000 volt. The total includes 2,900 kv.a. capacity on the Severn system, 1,650 kv.a. on the Wasdell's Falls system, 600 on the St. Lawrence system, and 5,250 on the Port Arthur system. During the year covered by the report, the total additional transformer kv.a. installed throughout the system was 7,425. The most considerable contract for transformers at present awaiting delivery is that for a 3,500 kv.a., 13,200/46,000 volt unit, which was to be delivered by February 24th of the present year.

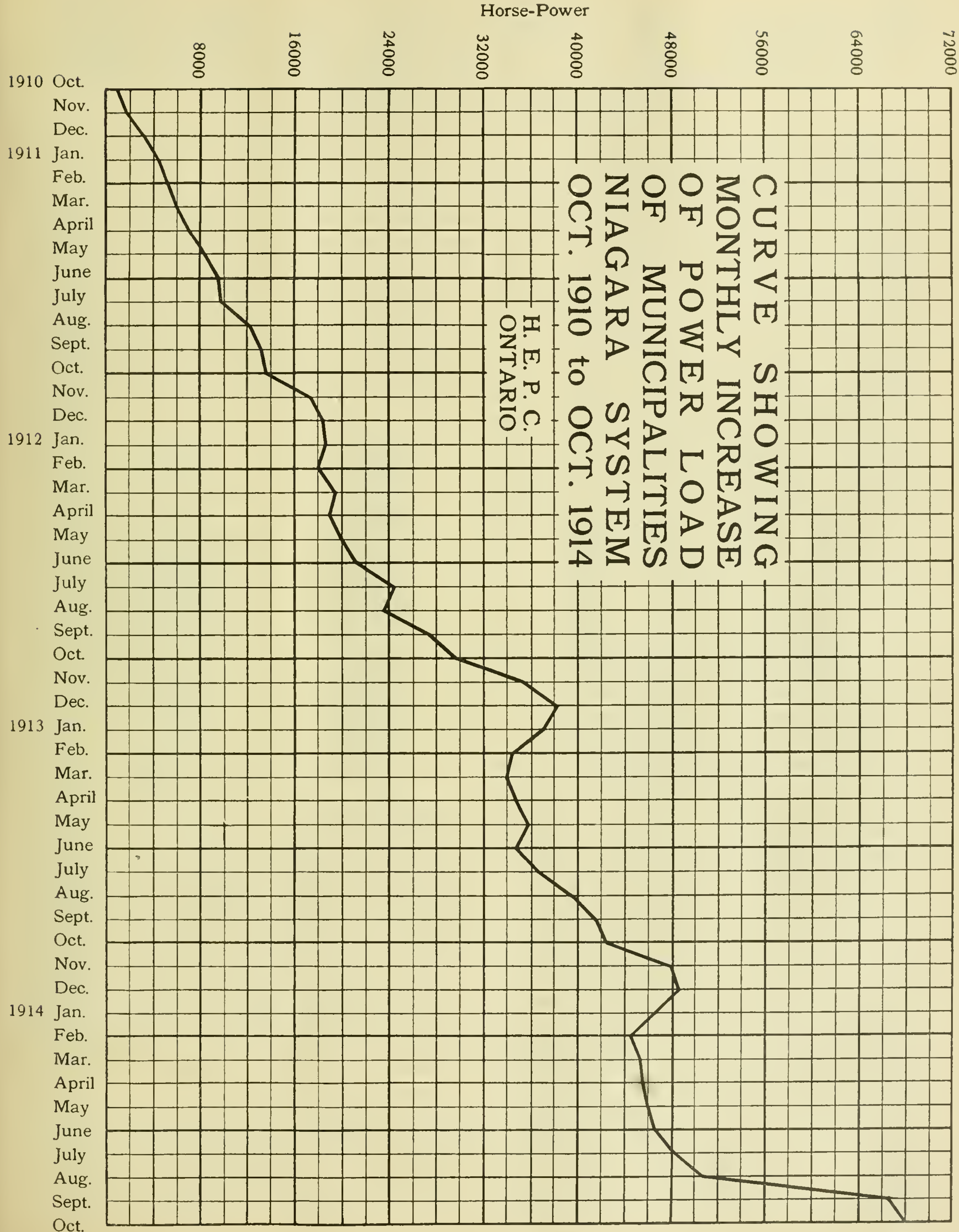
Extensions to the transmission system comprise a large proportion of the work of the year. A duplicate line from Niagara Falls to Dundas was started and has since been completed. This is a 4/0 B&S gauge copper cable. Tandem steel tower construction was adopted similar to the Windsor line already described in the Electrical News, and the standard span was 630 ft. This line is slightly over 50 miles in length. On the Windsor extension No. 3/0 B&S gauge copper cable was installed. Operation of the Windsor line was commenced on August 1st, 1914.

The year covered by the report has also witnessed the operation of the first generating plant installed by the committee, namely, the Wasdell's Falls system, which was started up in September, 1914. At this point two turbines of the vertical, double runner open flume type, with a guaranteed capacity of 600 h.p. each, operating under normal head of 12 ft. represent the total capacity of the falls. Operations at Eugenia Falls are well under way. At this point there is a calculated capacity of 8,000 h.p. with a static head of 530 ft. The initial installation calls for two 2,250 h.p. turbines, which are being supplied by the Escher-Wyss Company. These turbines are of the reaction type with spiral wheel cases and overhung runners, to operate at 900 revolutions per minute. The contract for generators and other electrical equipment has since been let to the Westinghouse Company.

The Commission's expenditure for the year ending October 31st, 1914, was $4,390,836, the largest in the history of this enterprise, which brings the total capital cost to date mentioned to $10,373,893.

The balance sheets of the municipalities consolidated into one report show the following results: number of municipalities now included in the report, 69. Total investment of these municipalities in distributing plants, $15,249,203. Total revenue for the year, $3,433,936; from which must be deducted operating and maintenance expenses, $2,012,754; debenture charges and interest, $661,949, and depreciation, $357,-883; leaving a surplus of $401,349. The number of light consumers is 93,179; power consumers, 3,565. The average cost per kw.h. for domestic light is 4.8 cents, and commercial light, 3.9 cents. The rates, depreciation and sinking fund reserve are so adjusted that a surplus is shown in every case.

The curve herewith shows in a very clear and definite manner the steady and rapid increase in the power consumption of this system. It will be noted that the peak comes in December, and we understand that the last December peak was very close to the 100,000 mark.


Horse-Power
8000
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CURVE SHOWING
MONTHLY INCREASE
OF POWER LOAD
OF MUNICIPALITIES
NIAGARA SYSTEM
OCT. 1910 to OCT. 1914
H. E. P. C.
ONTARIO

Fixation of Atmospheric Nitrogen

A chance to utilize Canada's water powers—Description of electrical processes and investigations to date (continued)

Three processes which have been commercially applied for directly preparing nitric acid from atmospheric nitrogen are first, Birckland-Eyde; second, the Schonherr; and third, the Pauling. These are diagrammatically shown in Figs. 1, 2, and 4. Fundamentally all operate on the same principle of forcing air into intimate contact with a high-tension arc and withdrawing the product nitric oxide, NO, as directly and rapidly as possible in order to reduce the amount of decomposition of the resulting product. As these processes have been repeatedly described in detail in the technical press, we will confine our attention to general comparisons.

Birckland-Eyde Process.—The Birckland-Eyde furnace, illustrated in Fig. 1, has been the most extensively used. Its most distinctive features are the use of the magnets A which distort the arc into a series of great wheels of flame, extending radially outward from the electrodes E located normal to the paper in Fig. 1. The air enters through the conduit C and is distributed to the arc through the holes in the fire-brick lining. The products are withdrawn from around the periphery at D. The voltage of 10,000 volts is reduced by an inductive reactance coil to about 5,500 volts across the electrodes. The alternating current of 50 cycles establishes the arc across the U-shaped water cooled electrodes E, spaced about 0.3 in. apart and a flow of current takes place across this ionized path, the electrons formed being repelled by the intense magnet field of the direct current magnets, A, and their discharge radially outward causes the arc stream to follow until it is deflected outward in a great semicircle. As its length is thus increased the potential across the electrodes rises and a second arc is established, the effect being to make a series of rapidly expanding arcs which are expanded across the entering air spaces. As the arcs travel radially outward the contact of the ionized arc stream with the incoming air disrupts the nitrogen molecule and causes the formation of NO, and the gaseous products travel rapidly to the periphery of the furnace where they are withdrawn at an average temperature of about 1,250 deg. Cent. The earlier Eyde furnaces were of 300 kw. capacity and gave a concentration of about 1.5 per cent. NO and a yield of about 500 kg. of nitric acid per kw. per year. The more recent furnaces are of 3,000 kw. capacity and give concentrations of about two per cent. NO and a yield of 580 to 600 kg. of nitric acid per kw. per year, or 65 to 70 grams of nitric acid per kw.hr.

Schonherr Process.—The Schonherr furnace (Fig. 2) consists of a long iron pipe 4 having an electrode E inserted in the bottom and the tube itself is the other electrode, the distinctive feature of the process being that an alternating current at 4,500 to 5,000 volts maintains an arc of from 23 to 25 feet. The furnace is started by forming an arc from the lower electrode to the wall of the iron pipe by means of a lever Z, a blast of air is then admitted to the pipe, whereupon the ionized gases are caused to ascend and carry with them the arc stream. In this way the arc is caused to travel toward the upper end of the tube where it is maintained. In practice, the air stream is admitted in a tangential direction causing a whirling motion to be imparted to the air surrounding the arc, this creates a vortex motion causing the arc to be surrounded by the cooler air and thus protects the iron pipe which is wholly unlined. The rapid passage of the air maintains an ionized path for the arc stream and the arc burns quietly. The products are withdrawn from the upper end and pass downward through the passes 1 to the outlet D. Previous to being withdrawn they are cooled by the water cooler and are further used to preheat the entering air. The temperature of the exit gases is about 850 deg. Cent. Provision is made for preheating the air by passing it upward in the space 2 of the casing and then downward to a point opposite the electrode. The largest furnaces are of 800 kw. capacity and maintain an arc about 23 ft. long. They give an NO concentration of about 2.25 per cent. and a yield of 550 to 575 kg. per kw.-year or 65 grams per kw.hr.

Pauling Process.—The Pauling furnace (Fig. 3) establishes an a.c. arc of 4,000 volts between two curved horns much after the pattern of the horn type lightning arrester. This arc when established is driven upward by a blast of air admitted at B and is disrupted by the diverging horns. A sheet of arc flame is maintained by re-establishing a new

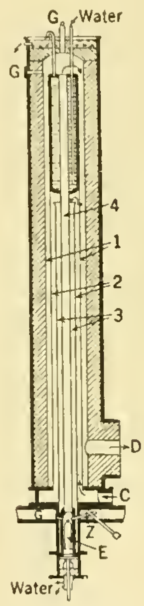


Fig. 1—Birckland Eyde Furnace

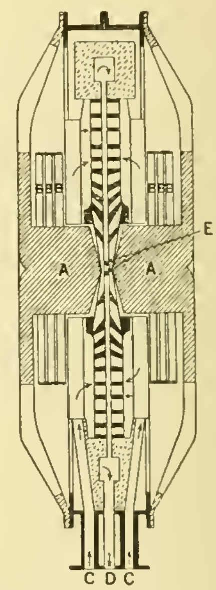


Fig. 2—Schonherr Furnace.

arc as the previous one is elongated. The effect is to create an arc flame about 30 ins. high and to have this flame in intimate contact with the rapid moving air used to blast the arc flame. Two furnaces are usually operated together and to assist in a rapid cooling of the products a portion of the previously heated or partially cooled discharged gases are admitted to the top of the furnace. The arc is established by the high voltage breaking down the gap between narrow blades C located in the horn gaps, and as these wear away they are continually advanced by the adjustments D. The percentage of NO obtained is 1.25 to 1.5 per cent. in the 400 kw. furnace while the yields are 525 to 540 kg. per kw.-year or 60 grams per kw.hr.

Power Factor and Electrode Wear.—In all these processes where the arc is distorted the power factor is about 70 per cent. being about 5 per cent. lower in the Schonherr type, apparently due to inductive effects of the iron pipe surrounding the arc. In both the Pauling and Schonherr furnaces the electrodes are adjustable and the air blast plays directly on the electrodes necessitating this adjustment and also means of easy renewals. The Pauling blades last less

than 24 hours, the Schonherr electrode is a straight rod of iron and is fed upward as it burns away. The Eyde water-cooled copper pipe not being directly in the path of the air blast lasts three to four weeks. In the operation of both the Eyde and Schonherr furnaces a furnace is placed on each separate leg of the three-phase circuit so that six wires are used for each generator. In the installations that have been made the furnaces are connected direct without transformers, and as no parallel operation of generators is attempted a large number of cables are required between the power house and the furnaces.

Efficiency and Losses.—It will be noted that notwithstanding the radically different types of these furnaces there is not a wide divergency in the yields, the Schonherr furnace showing the highest concentration of NO while the Eyde probably produces a slightly higher output per kw.hr. All of these concentrations indicate that the maximum temperature of the arc is not utilized but is very considerably reduced by the large amount of air admitted. If the temperature of the arc is raised by admitting less air there is a heavier decomposition of the products and all products are heated to a higher temperature with a corresponding loss, the net result being a lower yield per kw.hr. As the yield per kw.hr. is of fundamental importance, adjustments are governed accordingly. The concentration of NO affects directly the apparatus for recovering the products, such as the absorbing towers, and the lower the concentration of NO the greater the losses from heating the inert gases. The furnace efficiency will largely be determined by this factor. Let us take for example a concentration of 1.75 to 2 per cent. NO and examine the distribution of heat. If we take the specific heats of a molecule of the diatomic gases as constant, there will be no difference in the specific heats per molecule of N, O or NO, and taking a standard value for this we may calculate the heat energy expended. Let us assume, following Haber, that for a change of temperature t, the specific heat per molecule will be

$$6.8 + 0.0006\ t$$

The gaseous products heated in the furnace with 1.75 to 2 per cent. NO concentrations will have, from Nernst constants, an absolute temperature of about 2,500 deg. and the air would have an initial temperature say of 27 deg. Cent. or 300 deg. absolute, so the arc would raise the temperature of the 100 molecules through 2,200 deg., or

sensible heat = 100 (6.8 + 0.0006 t × 2,200 deg.) 2,200 deg. = 1,786,400 calories.

As two molecules of NO require a latent heat of formation of 43,000 calories, the total heat will be 1,829,400 gram-calories; and as one watt hour equals 860 gram-calories the energy represented will be equal to 2.12 kw.hr. for two gram-molecules of NO. Taking the atomic weight of N as 14 and of O as 16, the gram-molecule of NO will weigh 30 grams, so 2.12 kw.hr. will form 60 grams of NO.

If we mix this NO with air and water it will form nitric acid without requiring a further expenditure of energy, thus,

$$2\ NO + 1\tfrac{1}{2}\ O + H_2O = 2HNO_3$$

and the 60 grams of NO will then become 126 grams of HNO_3; the production of nitric acid will then be 126 grams per 2.12 kw.hr. or 59.4 grams of HNO_3 per kw.hr. Of this expenditure of 2.12 kw.hr. the formation of the nitric oxide utilized

$$\frac{43,000}{1,829,400} = 2.35 \text{ per cent.}$$

and the sensible heat imparted to the active gases to raise their temperature to form two molecules of NO required 35,728 calories, so this represented

$$\frac{35,728}{1,829,400} = 1.95 \text{ per cent.}$$

while the heating of inert nitrogen and oxygen or that portion of the air which was not utilized but which was heated to the furnace temperature was represented by

$$\frac{1,750,672}{1,829,400} = 95.7 \text{ per cent.}$$

These calculations while open to some criticism on account of the uncertainty of the figures for specific heat and its change with temperature, closely approximate the conditions, and indicate that low concentrations of NO when formed from thermal reactions are extremely wasteful. If concentrations of 10 per cent. NO are obtained with temperatures of 4,200 deg. to 4,300 deg. Cent. the yields may be increased to 135 to 140 grams HNO_3 per kw-hr., but the greatest saving in energy will result in utilizing other than purely thermal energy. While thermal energy may be produced more cheaply directly from fuel, its temperature possibilities are again limited by the inert gases of combustion if air is the source of these.

Hausser has commercially applied a process for utilizing coke oven gases by means of an explosion bomb. The amounts of excess gases may be limited and the intimate mixture of combustible and oxygen due to pre-compression of the charge permits of high combustion temperatures being reached. Fig. 4 shows this bomb having a capacity of 1,600 cu. cm. The gases, either illuminating or coke oven gases, enter through the inlet after previously exhausting the air by means of the air pump outlet. Means are provided at A for injecting under high pressure a spray of water to cool

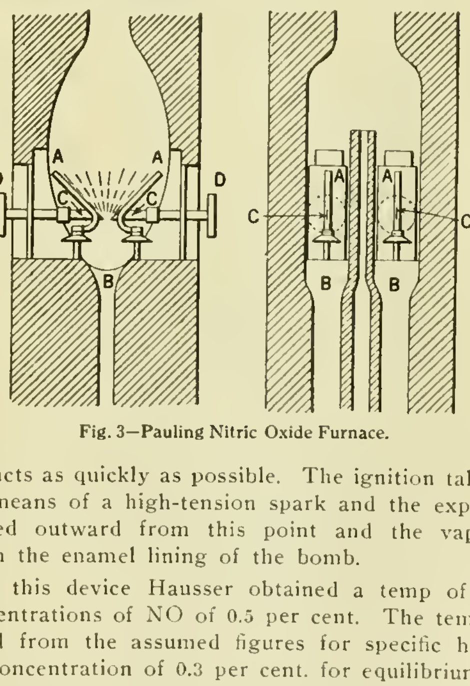


Fig. 3—Pauling Nitric Oxide Furnace.

the products as quickly as possible. The ignition takes place at 2 by means of a high-tension spark and the explosion is propagated outward from this point and the vapor condenses on the enamel lining of the bomb.

With this device Hausser obtained a temp of 2,100 T and concentrations of NO of 0.5 per cent. The temperature calculated from the assumed figures for specific heat indicated a concentration of 0.3 per cent. for equilibrium by the Nernst calculation and Hausser sought to explain this increase of yield as due to a chemical reaction induced by photo-chemical effects similar to the ionization by ultra-violet or actinic rays of light. The maximum yields were 99 grams of HNO_3 per cu. m. of gas, or equivalent to 6.2 lbs. of HNO_3 per 1,000 ft. of gas. A commercial plant on this system has been installed in Germany. This low concentration of NO greatly complicates the commercial application as the absorbing devices are more cumbersome and the percentages of loss are higher.

Method of Utilizing NO.—All of the above nitric acid processes utilize the reaction

$$2\ NO + O_2 = 2NO_2$$

which is an exothermic one for the formation of the peroxide, and if the temperatures are controlled, side reactions can

be prevented and equilibrium can be maintained with only a small percentage of NO remaining. The gases after leaving the furnaces are usually carried through waste heat boilers where 50 to 60 per cent. of the heat is utilized for steam production. They are then cooled in aluminum pipe coolers and allowed to enter a gas holder where time is given to form the peroxide. The products then enter counter current absorption towers where the reaction with water forms

$$2NO_2 + H_2O = HNO_3 + HNO_2$$

the nitrous acid HNO_2 is further oxidized and utilized to form HNO_3 in contact with the excess oxygen in the gases and with the absorbing water. The final recovery is usually made by circulating the gases through two towers of weak alkaline solution, such as sodium carbonate and this is converted into sodium nitrate and into sodium nitrite, and recovered by evaporation, the final products are a combined nitrate-nitrite of sodium. A normal circulation over three absorbing towers gives an acid of about 30 per cent. concentration but this can be increased to 45 or 50 per cent. by recirculating over the first tower. Further concentrations are usually made by evaporation. All of these processes are simplified by increased concentrations of NO in the initial reaction. About two to three per cent. of the original NO is discharged in the waste gases from the absorbing towers.

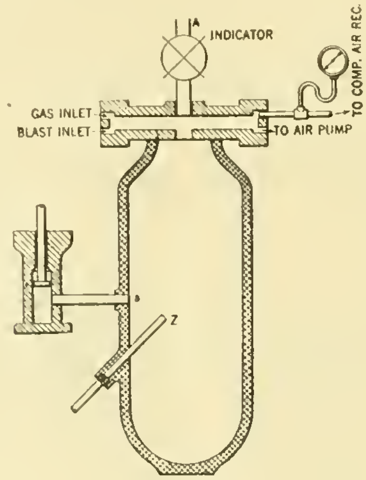


Fig. 4—Hausser process.

It will be noted that one great advantage of these processes is that they require the handling of only air, gas and water up to the time the nitric acid is formed in the absorbing towers, so that the simplest handling devices suffice, and the labor is a minimum, also no chemicals are required until the final washing with the alkaline solution in the absorbing towers, and this may be a cheap solution such as lime water if conditions make it desirable.

Cyanamide Process.—The very low yields, representing less than 5 per cent. of the energy expended and amounting to 65 kw.hr. per kg. of N fixed, naturally have turned attention to chemical reactions as a means of increasing the yields. One of the most important of these is the process for making cyanamide $CaCN_2$.

The endothermic reaction and the heating of the materials entering into the calcium carbide reaction have an approximate theoretical value of 3.1 kw.hr. per kg. produced, whereas it requires about 4 kw.hr. to produce a kg. of 85 per cent. calcium carbide in the best practice. For 100 per cent. carbide it would require 4.7 kw.hr. and the efficiency is therefore,

$$\frac{3.1}{4.7} = 66 \text{ per cent.}$$

The union of carbide and nitrogen is exothermic when a sufficient temperature is reached so the actual expenditure of energy for this reaction is not in excess of 0.1 to 0.2 kw.hr. additional for the fixation of nitrogen. We require further the preparation of the nitrogen, and the grinding of the carbide to prepare it for the nitrogen treatment. The cyanamide can be used directly in the fertilizer industry, but for use in the chemical industries it must be decomposed to form ammonia, or if nitric acid is required it must be made from the ammonia by some process such as the Ostwald contact process. We may figure however, that the yield for a given amount of electric energy which amounts to about 16.6 kw.hr. per kg. of N fixed, is from four to five times the yield of the direct nitric acid processes, while offsetting this is the cost of preparing the nitrogen, the cost of chemicals, the handling of materials at high temperature, and the many factors making up manufacturing costs.

The Serpek Process.—The Serpek process is typical and has been quite extensively introduced commercially. The reaction is represented by the equation

$$Al_2O_3 + 3C + N_2 = 2AlN + 3CO$$

The reacting temperature for best results is claimed to be 1,800 deg. to 1,900 deg. Cent., but no effort is made to define the equilibrium conditions and it is very evident that where CO enters so actively into the reaction the temperatures can be materially altered by a change in the partial pressures of the N and CO. One of the most interesting features of this process is that the impure Al_2O_3 in the form of bauxite is fed into the furnace together with coal and the sensible heat is therefore partially derived from the coal. Neglecting the specific heats of the solids, the endothermic reaction requires three kw.hr. per kg. of aluminum nitride, having an approximate content of 26 to 34 per cent. N.; it would require therefore 9 to 10 kw.hr., per kg. of N under the best conditions if the coal and producer gas were capable of supplying all the heat energy required to produce the required temperature in the gaseous and solid products. In the case of cyanamide it requires about 4 kg. of high grade carbide per kg. of nitrogen or a kg. of N requires 16 kw.hr. under favorable conditions and about 0.2 kw.hr. for heating the carbide against 10 to 12 kw.hr. in the Serpek process. If all energy were supplied from the electric source the Serpek process would require practically the same electrical energy as the cyanamide process.

There is a distinct advantage in being able to use producer gas in place of preparing purified nitrogen and there is a further advantage in conducting the process with one operation. In practice Serpek uses a revolving barrel furnace of the resistance type the resistance consisting of a squirrel-cage construction which continually agitates the material as it passes through. In all nitride reactions this is essential, as the materials become coated with a covering which protects the interior and prevents further absorption of nitrogen. Serpek feeds bauxite and coal from a producer type of furnace into this revolving electric furnace and the sensible heat is thus utilized to heat the material as it travels to the electric furnace the product is discharged from the electric furnace as aluminum nitride with a content of 26 per cent. to 34 per cent. N.

The aluminum nitride can be treated with steam and the N converted into ammonia or the ammonia may be converted into nitric acid. Serpek claims a process for converting the nitride directly into nitric acid but no details are available. One drawback to using Bauxite is that the resulting aluminum oxide is more difficult to use than the impure bauxite and the process does not work as economically, it is probable that some cheap catalytic agents may be found to substitute for the bauxite but otherwise the Serpek process should necessarily find its greatest application in connection with the reduction of aluminum.

Haber-Catalytic Process.—One other process which has attracted marked attention on account of the scientific emin-

ence of its inventor as well as the commercial results obtained is the Haber process for the synthesis of ammonia directly from its components N and H. This means that there must be a supply of these elements available or they must be cheaply produced. The reaction is an exothermic one producing 11,000 calories per gram-molecule so the problem is not so much the energy consumption as the peculiarities of the reaction

$$N_2 + 3H_2 = 2NH_3$$

The ammonia formed is practically decomposed at 750 deg. Cent. It has been difficult to get any substance to react with the N at this low temperature, and while the nitrogen was made active toward many substances it was easy to decompose the resulting NH_3 into its constituent molecules and all yields obtained were too low to justify commercial results. Haber's success seems due more to ingenuity in constructing his apparatus and to the discovery of a suitable catalyzer than to any departure from previously known principles. The fact that one molecule of N and three of H form only two molecules of ammonia indicates that the volume occupied by the ammonia will occupy only one-half the space occupied by its constituent gases and hence this contraction of volume will be assisted by pressure. Haber increased the pressure on the reacting gases to 200 atmospheres, and as a catalyzer he used uranium. He found at 500 deg. Cent. he could react on the nitrogen and upwards of 8 per cent. of ammonia could be formed before equilibrium took place. By using limited amounts of N and an excess of H the equilibrium pressures were adjusted well within the decomposition limits of temperatures and by withdrawing the gases from the catalyzer as they reached equilibrium the process was made continuous. The fact that decomposing ammonia creates a most destructive corrosive agent had to be met and the retorts had to be made strong enough to stand the effects of the high pressure, and also possible explosions, as hydrogen compressed to 200 atmospheres and heated to 500 deg. Cent. is a most active agent in the presence of impurities such as oxygen, sulphur, etc. The retorts can be made of very moderate size, and a number of them used and by heating internally with electric resistance the shells are not subject to the effects of temperature, so the process seems to have met with very pronounced technical success. The consumption of energy for heating the gases is very slight as the exothermic reaction will compensate largely for the heat required to release this.

(Concluded in June 1st issue.)

High Tension Outdoor Sub-stations

By H. W. Young*

Practically every central station has to raise a considerable amount of new money each year in order to extend the service. The investing public will not take their money from savings accounts and buy securities of the public service companies unless convinced that the management is making extensions which will, eventually at least, prove profitable. This is especially true at the present time, for the inclination of the average man to take chances has been supplanted by the demand that the investments prove safe.

Very many high tension transmission lines pass through districts in need of electric service, and many residents in these districts are willing to pay a reasonable price for such service. With these conditions confronting him, what can the central station manager do to secure loads which will prove profitable, and attract the investing public? The obvious answer is the low cost, outdoor, self-contained, substation.

Do not misunderstand this statement and think that a group of small consumers, always, can be made profitable customers—if it entails building long lines. Assuming, however, that the lines are built, you can—by means of outdoor sub-stations—sell power at a profit to those whose houses, farms, mills, dairies, etc., border on the transmission lines.

Conditions the Sub-station Must Meet

1st.—It must not interfere with the operation of the main lines.

2nd.—Disturbances at sub-stations caused by short circuits, overloads or lightning, must be localized and not permitted to communicate.

3rd.—The sub-station cost per kilowatt must be low, so that the installation will return a profit.

4th.—The construction must be such that the capacity may be increased by simply changing transformers and fuse capacities.

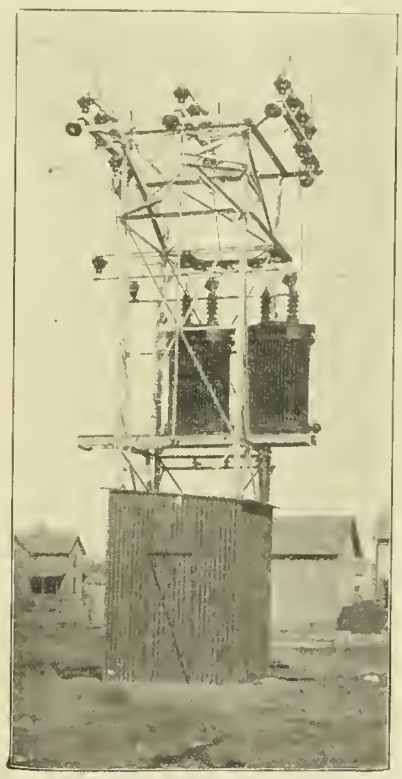
5th.—All essential elements must be in plain sight so that their conditions can be noted without difficulty or danger.

6th.—The installation must be safe, easily operated, and fireproof, if possible.

7th.—The design must be such that a station can be taken down and set up at another point with minimum expense—in short, have a high salvage value.

Necessary Equipment of Stations

The outdoor sub-station in its simplest and most practical form, comprises a supporting structure for the trans-



formers, a high tension air break switch, a set of primary fuses and lightning protective equipment. The primary fuses should be so installed and rated that protection will be secured against current rushes, caused by short circuits

* President Delta-Star Electric Co.

or severe lightning disturbances. Protection against pure overloads should be secured by the use of low tension secondary fuses, or oil circuit breakers.

The high tension switches should be of such a type that all phases can be simultaneously opened or closed by a single control handle. These switches should be provided by arcing horns to prevent burning of the main contacts during opening. Switches should be immune from trouble due to ice formations during heavy sleet storms, for while ice formations and the necessity of switch opening are rarely coincident—yet, it may happen.

Lightning arresters should be of such a type that they will effectively discharge, have a low maintenance cost and prevent local disturbances spreading to the main lines.

Cost Per Kilowatt

The cost per kilowatt will, of course, be governed by the type of apparatus selected and the amount of time spent in engineering, designing and erecting the station.

When possible, it is advisable to use standard or "ready-made" sub-stations, rather than special designs. The prime object in distributing high tension power is to make a profit for the central station. Time is money, and it costs both to call in operating engineers to design stations, incur draughting room expense, consume the time of department heads, etc. When it is decided to supply a consumer from the high tension lines, try to use a standard station, as there is a type for practically every service.

The standardization of steel tower outdoor sub-stations such as shown in the accompanying illustration, is of real importance to the user, as it eliminates the chance of error, always present when such equipment is designed by local men, to whom it is special or unusual work.

It should be borne in mind that the cost per kilowatt rapidly decreases with increasing station capacity. The original installation should therefore be such that as the load increases, its capacity can be increased at minimum expense. With the standard control and protective equipment now available, it is simply necessary to replace the original fuses with those of heavier rating.

Conclusion

Often, it is claimed, that the farmer or small community man is slow to take up the use of electricity. This same class, at first, gave the automobile scant consideration—but, a proper educational and sales campaign has made the farmer an important factor in the automobile field.

The desire for electric service simply needs stimulation, and once its convenience, decreased fire risks, real economy, etc., are understood, the way is open. One of the real obstacles to increasing transmission lines revenue, is the indifference to what might be termed sales spirit. In short, after a consumer is connected, the transmission company too often forgets the possibility of increasing his load. It is not good policy to spend all the time in securing new consumers, as the present ones can be educated to materially increase their electric service, thus increasing current consumption.

However, when endeavoring to sell power from high tension lines, if the question of cost comes up, do not forget that farm money is being spent every day for automobile tires, gasoline, oil, accessories, etc., and a large part of this money is spent for convenience, pleasure or service—not necessities. The farmer has been educated to automobile and he can be educated to electricity supply.

Electric service has given civilization a tremendous impulse for the better. The telephone and telegraph are rapidly coming within universal reach of the rural population. Electric light and power is also coming to the front, and soon will be counted as a real factor in the advance of civilization conveniences.

Electric Taxicabs in Numerous Cities

By A. Jackson Marshall*

The fitness of the electric taxicab for city traffic is fast establishing itself in the minds of many taxi and rental service owners. One of the foremost advantages that recommends it so strongly is its low operating cost. That it is cheaper to run than either gasoline or horse-drawn vehicles, has been proved beyond a doubt. Electric current is cheap, while the modern powerful storage battery is wonderfully efficient. Tire expense of an electric is reduced to a minimum and its simplicity of mechanism eliminates heavy repair bills. This is of vital importance in a business based wholly upon running vehicles for profit and where economy is of more importance than running a private pleasure car as a luxury.

Probably the best example of electric taxi development in the United States, strange to say, is in Detroit—the home of the gasoline car. The Detroit Taxicab & Transfer Company, which is one of the oldest gas taxicab companies in America, is now operating a fleet of 10 "electrics," which is being increased to 70 or more. It was only after much experimentation that this company became convinced that the old style cab had grave faults, and began a campaign for "better taxis." The first "electric" with which this company experimented showed a mileage of 1,375 miles in one month, and by the time it had run 12,000 miles it had proved itself beyond a doubt. In all this time, this car had not had any accidents or repairs, and had gone through mud and high snow banks, and over the roughest kind of pavements. That it was the most popular taxi in the service and was always in demand, proved that the public wanted electric taxis.

It was felt that the general efficacy of the electric taxicab would force recognition in the near future, but even the writer's most sanguine expectations have been more than fulfilled, for there is now concrete evidence that the next few months will witness an initial installation of electric taxicabs on a large scale in New York. The company responsible for this introduction will shortly thereafter extend its service on a large scale in all the principal cities in this country and it would appear that the specially high grade electric taxi service will rapidly attract the cream of the taxi and rental service in the cities in which these "electrics" are introduced.

It probably would be of interest at this point to report an interview which the writer had recently with Mr. E. P. McDowell, of New York, former President of the Renault Taxi Service Company, and later President of the Motor Taximeter Company. Mr. McDowell has been identified with the rental of cabs for many years and has had experience with both gasoline and horse-drawn vehicles.

"The first taxicabs," said Mr. McDowell, "were introduced into the United States from Paris and London about nine years ago, and at the beginning were a great success. They were such a novelty and the rates seemed so low that it was almost impossible to supply the demand. This re-

* Secretary Electric Vehicle Association of America.

sulted in the formation of numerous taxicab companies. Very naturally competition became keener and profits smaller, due chiefly to the fact that dead mileage increased. The public had learned gradually to hire a taxi to go from point to point knowing that after paying and dismissing the chauffer, another cab could easily be procured if desired. They had learned not to pay for waiting time, which had usually been done before.

"A great many taxi companies of the get-rich-quick type sprang up with alluring prospectuses to entice investors, and very soon over forty companies were operating in New York City. However, they existed for only a short time, ending in bankruptcy and losing all the investors' money. The legitimate taxicab companies greatly suffered during this time of instability and speculation, and by 1913 only eight companies were operating out of nearly fifty that were in business in 1911.

"In 1913 the public agitated a movement for cheaper rates and one of the New York papers started a campaign for low rates and abolishment of private taxicab stands in front of hotels and clubs, etc. This was finally accomplished about August 1, 1913, and former private stands were thrown open to the individual or public chauffeur, and the rates were reduced. After one year's trial, the result of this at the present time is evident. It has been a decided failure. In the first place, many chauffeurs had been discharged from various companies for dishonesty and bad conduct, and after the city's ordinance had been passed, these men bought cheap second-hand cars, and started in business. These very men are today a constant menace to the safety of the public. Not only are the lives of their passengers often endangered—as the police court records will show—but pedestrians are in just as great danger from the incompetent and reckless driving of many taxicab chauffeurs.

"The rates having been arbitrarily reduced, it was impossible for the taxicab companies to renew their equipments and keep up to their former standards of high-class service, which cost 32c. per mile. This figure is entirely accurate as I know from my own experience, having owned and operated the best foreign and domestic gasoline cars for several years.

"From my past experience, I have also found that one of the most uncertain expenses in operating the gasoline taxicab is the cost of damage and accident claims. The use of excessive speed by chauffeurs, in streets where traffic is congested, coupled with the carelessness of pedestrians, is a source of bad accidents in New York.

Discarding His Gas Taxis

"A short time ago, my attention was called to the fact that Mr. Scriminger, owner of the Detroit Taxicab and Transfer Company, perhaps the oldest taxicab operator in this country, was fast discarding his gasoline taxis for electric taxis. This event created a great impression on me, particularly as it happened in Detroit, the home of gasoline cars in America! I at once started a quiet investigation with the following results. I became convinced that the only safe and sane cab for city use is the electric taxicab. Its advantages are so numerous that it is almost impossible to cite them in such a limited space. In the first place, I have observed that the "electric" has by far the lowest operating cost. The cost of current is low, repair expense is marvelously low, and the life of an "electric" is from 10 to 15 years or more. The electric taxicab maintains a good average speed, running smoothly and silently without the sudden spurts caused by the whimsical chauffeur. Simplicity and positiveness of control insure instant stopping, and there is no lost time in traffic on account of changing gears. The "electric" starts as quietly as it stops and is well under way before the other cars have "picked up."

"Another advantage which should appeal especially to the patrons of taxicabs is the absolute cleanliness of the "electric" in every detail. There is no oil, no engine dirt which soon produces a grimy, unsightly operator. There is none of that obnoxious and penetrating gasoline odor and smoke. The passenger is able to sit back comfortably and enjoy his ride without nerve-racking exhaust explosions or grinding of gears. He can converse easily in ordinary conversational tones without continuously straining his voice to a high pitch in order to overcome the noise of the gasoline engine.

"Not one of the least advantages is to the chauffeur himself. Any operator who has driven a gasoline taxicab, through the crowded congested streets of New York, will tell you that it is like getting a vacation to drive an electric taxi. The importance of this ease of operation has a direct bearing on accidents. The over-strained and tired-out chauffeur is much more likely to be involved in accidents than the operator who has not been overtaxed.

59 Miles per Charge

"With several months of tests over stiff hills and in city traffic, I have maintained an average of 59 miles on a single charge. Experience has shown that the average daily mileage of an active taxicab for a ten-hour day is about 35 miles, well within the capacity of one battery charge. With the charging facilities now available, the electric taxi may be boosted at relatively high current while waiting at stands for calls which enable the "electric" to obtain almost unlimited daily mileage.

"It is interesting to note that some of the large gasoline taxi fleets have only about 65 per cent. of their entire equipment, including taxis waiting at stands, in operation at any one time, while the remaining 35 per cent. are either inactive or in the repair shop. Add to this the fact that gasoline taxis are usually operated only 11 or 12 hours a day, and it will be realized that there is a large amount of inactive investment which naturally influences the operating costs considerably.

"It is quite possible to operate the electric taxicab 20 or more hours a day with two shifts of chauffeurs. But this method, although tried in the operation of gasoline taxicabs has never proved successful. The economy of long hour operation of electric vehicles is at once evident.

"I am so positive of the future of the electric taxicab that I have recently been successful in interesting a number of prominent owners of gasoline equipments in a company about to be formed. These men are just as enthusiastic as I am over the prospects of introducing the electric taxi on an extensive scale. We are assured that this system will eventually become national in scope and our plan is to have an electric taxi and rental service agency in every large state of the Union.

"I have been experimenting with several makes of electric vehicles for the past few months and I am agreeably surprised to find that they can be operated for something in excess of 20 per cent. less cost than a gasoline car. They are well constructed, and there is continuous improvement in design and speed. They are much lighter in weight than formerly. A lower rate of insurance is a thing that will further reflect the economy of operation. Owing to the positiveness of control of the "electric," collisions are reduced to a minimum and insurance companies will be compelled to give justifiable, preferential rates.

Cleaner, Saner and Safer

"As I said before, time and space permit me to name only a few advantages of the electric taxicab over other modes of transportation and I have touched only on the most salient points. The people of Detroit have shown their decided preference for the cleaner, saner, and safer taxicab, and unless I am greatly mistaken, the New York public will

(Continued on page 40)

Electric Railways

Successful use of one-man cars—Cuts operating costs, easily maintains schedule and tends to reduce accidents

The operation of one-man cars, while not to be recommended for general use or to serve large or congested city areas, is, however, apparently winning favor under special conditions. Several of the street car systems of Canada have been set going during the boom times of the past few years, when populations were increasing rapidly and business in general promised a steady improvement. Under present conditions, many of these roads find themselves quite unable to meet operating expenses and are confronted with the necessity of curtailing in every possible way to meet the conditions produced by their diminished incomes. To these the one-man car seems to offer attractive possibilities.

That a road so favorably known as the Illinois Traction System should use and approve this type of car is, in itself, sufficient reason for considering them. Mr. J. M. Bosenbury, superintendent of motor power and equipment of the Illinois Traction System, recently read a paper before the electric railway association of that state, in which he claims very considerable economies from the use of these cars, without corresponding disadvantages. He states that schedules can be maintained, accidents are actually fewer, and that the net saving in operation will vary anywhere from 8 to 14 per cent., compared with which the cost of re-arranging for one man operation is almost negligible. Interesting extracts from this paper are given herewith:

If, through the use of the one-man car, it is proposed to place upon the motorman the responsibility for collecting fares and issuing transfers in addition to his other duties, it is manifest that some arrangement should be afforded to simplify and to make safe the method of operating the car. Concentration of the operating devices to which the motorman must give attention is an important requirement, and this may be effected by combining the air-brake valve with the door-operating and step-operating mechanism. Such a combination should provide for stopping the car in the ordinary way and at the same time should open the doors and lower the steps without requiring the motorman to remove his hand from the brake-valve handle. Furthermore, the operation of the air brakes or the operation of the doors and steps should be so controlled that either could be accomplished independently. It is also desirable to include with these functions the application of sand to the rails by means of the brake-valve handle during the progress of a stop and without interfering with any of the other operations.

Used on Illinois Traction

All of the foregoing requisites have been observed in the one-man cars that are now used on several of the properties of the Illinois Traction System, and, in addition, as the air-brake equipment on these cars is provided with the emergency feature, automatic operation of the emergency valve is provided if the motorman's hand is removed from the controller handle when it is in running position. A rear or emergency door has been provided also, and this is so arranged that if an emergency application of the air brake is made both front and rear doors and steps are automatically thrown open, the release of the air brakes closing them. This is the only circumstance under which the rear door and steps are operated. When the brake valve handle is moved to emergency position by the motorman, sand is automatically applied to the rail.

The principal objections which have been advanced against one-man car operation are that it might retard the schedule by lengthening the time of stops. The difficulty of attending to the trolley is also considered an undesirable feature. With regard to the effect on the schedule, it may be said that the handling of passengers is largely a question of car design and arrangement. Under the present system of two-men operation the number of unpaid fares on the platform when the car starts is primarily a question of the location of the conductor. But in any case it is highly desirable to have as many passengers seated as possible, or at least past the platform, when the signal to proceed is given, and herein the one-man car does not suffer by comparison.

Attention to the trolley or other parts of the car under one-man operation is under about the same handicaps as it is with the fully-inclosed cars of two-man type. Furthermore, the question of the trolley coming off the wire is largely one of maintenance, and it has been found that this criticism has not been borne out in the case of cars with two men when both of them are stationed on the front platform.

Step accidents unknown

In general it has been observed where one-man car operation is practiced that the undivided responsibility has produced a degree of efficiency in operation not normally reached with two-men operation. Step accidents are unknown. Where a comparison has been made between the two methods of operation the results so favor the one-man car that in one instance a claim department has actually requested the use of more cars of this type. The net savings in operation has been variously estimated to be from 8 per cent. to 14 per cent. of the gross earnings and the cost of arranging a car for one-man operation is almost negligible in comparison.

The attitude of labor toward the introduction of the one-man car will probably be antagonistic, but if any considerable saving can be effected, it follows that the railway company will be in a position to provide better service for its patrons, and to reach this desirable condition the transportation companies must be met half-way by the public. With the possibility of more frequent service, combined with adequacy and at least an equal degree of comfort, it is fair to assume that once the proposition is thoroughly understood co-operation from the public will follow.

Railway Must Pay Costs

The Dominion Railway Commission has made an order, requiring the London & Port Stanley Railway System to pay the costs of elevating the Bell Telephone Company's wires at crossings.

The New York, New Haven and Hartford electrification—A year's experience of high voltage operation*

We are rapidly putting far behind us the days when the attitude of railroads was to sit by and watch some one or two other railroads experiment with electricity as a motive power. Indifferent interest has given way to the realization that pioneer roads which have been using this new power in every form of railroad movement have developed a fund of data which entitles it to more than passing interest, and requires that they be keenly alive to the possibilities it may hold out in the matter of betterments to their own property.

That a thing of any character has the right to live and improve is based entirely on whether it is founded on correct principles. In the early days when electrical movement was first introduced on heavy traction railroads, theory was strong and practice severely limited. The guiding principle upon which electrical men based their opinion that electrification had its proper place in the economic world, was that by its use certain savings could be effected that would justify the investment necessary to secure it. There was entirely outside of this, but indirectly an economic factor, the advantage accruing to the passenger in the form of a clean ride.

While I have, of course, been keenly interested in electrification that has been applied to other railroads, naturally the past ten years' association with the New Haven work, during which time over $15,000,000 have been expended in this department of betterment, has brought the real elements of its progress within very close range.

In June, 1914, the first New York, New Haven and Hartford passenger train was operated from Grand Central Station to New Haven over a four-track electrified route, 73 miles in length. Between New York and New Haven, measured upon a single track basis, there are some 500 miles of electrified line, of which 184 are included in yards and sidings. On these tracks today, every class of passenger, freight and switching movement is made, and electrical statistics are kept of all power house, line or equipment failures, a reference to them suggesting the features of electrical operation that require first attention for the betterment of service. These statistics of electrical operation will doubtless be available in the Franklin Institute Transactions in a short time.

Freight and Switching

A feature of electrification that at present is the most appealing to one who has given the subject some consideration, is in the matter of freight and switching movements. Since 1907 the New Haven Road has been operating its regular 100 per cent. electric passenger service between Stamford and New York. But recently, experience with regard to electric movement in switching and classification yards, and more recently that with regard to freight movement on main line track, has indeed been a revelation in the possibilities of heavy electrical traction. For example, during the month of January past, on the New Haven over 40,000,000 ton miles trailing load were handled by electric locomotives, this total tonnage being made up of fast, slow and local freight movement. There are installed on all of the electric engines wattmeters to register the kilowatt hours of consumption. Records of these wattmeters indicate that fast freights require on the order of 34 kw. hours per train mile; slow freights on the order of 60 kw. hours per train mile; local freights on the order of 36 kw. hours per train mile. These figures being for trains varying in tonnage from 1,000 to 3,000.

Of interest also are the kilowatt hours per 1,000 ton miles of trailing load. For fast freight the kilowatt hours per 1,000 ton miles are on the order of 30; for slow freight 30; and for local freight 85. I make mention of these figures only to illustrate this new and vast sum of information that is daily coming to us. The "watt hour constants" are of necessity average figures, made up of trains having varying weights and schedules, and yet the records from which they are taken admit of instant segregation into any class of service for which a constant is desired. The question that might be asked in looking at these constants is: What do they signify? And the answer is brief; an electrical ton mile as against a steam ton mile reduces the coal pile in a ratio of 1:2.

While our present freight movement by electricity on the main line is today limited both on account of the general depression in business, together with the fact that a full complement of electric freight locomotives is not yet at hand, a record of one day's movement of electric freight trains between Harlem River and Bridgeport shows 14 trains, 804 cars and a tonnage of 28,159. There is no question in my mind but that the greatest returns to be secured by electrification will be through freight movement.

Expense Reduction

While in the past we have appreciated the economies to be secured through electrification, in virtue of lesser expenditure required in fuel and maintenance of electric engines as against steam, there is fast coming to the front what might be called a more visualized economy in the reduction of expenses by effective savings in train miles.

Illustrative of the economic value of a "kilowatt hour" in its application to an electrification system, I quote from a part of a recent letter which had reference to the utilization of some 4,500 kw. of demand in connection with its application to the eastern section of our electrification zone. I would particularly draw your attention to the item of $49,275, which has reference to the economies to be gained by the double heading of freight trains operated between Harlem River and New Haven. This economy, and its automatic complement, the increase of track capacity, are the phases of electrification that are striking deep into the consideration of the steam operation railroad man.

"(1) The extension of the station contemplates, as you know, supplying a maximum single-phase demand of approximately 4,500 kw. This amount of power measured by train units, would permit the operation of twelve additional daily trains in fast freight service of average tonnage, or its equivalent in any other class of service between Harlem River and New Haven.

"(2) The number of kilowatt hours which would be consumed by the above twelve trains would be 17,500,000 kw.h. annually, and, as previously discussed with you, upon a coal ratio of 1 to 2 in electric and steam service and a basis of three lbs. per kilowatt hour and $3.00 per ton, an annual saving to the railroad company of $78,750 is indicated.

"(3) Further translating the above movement into engine miles, our log sheet records indicate that the number of engine miles required for the above movement would be 990, which multiplied by the difference in cost of engine repairs at 5 cents per engine mile, effects annual savings of $18,250.

"(4) The transfer of twelve daily trains from steam to electric service will permit a further extension of our present practice of 'double heading' trains in electric service, thus saving 450 daily train miles, which as shown by our log sheet will secure an annual reduction in train wages of 30c. per train mile, corresponding to an annual reduction of $49,275.

"(5) A supply of approximately 3,000 kw. (average) to the New Haven end of the line will effect a further saving of $16,500 in transmission losses, as compared with the trans-

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mission losses of the same amount of power from Cos Cob Station; the above savings being based upon the conservative cost of 5 mills per kw.h. In explanation of the apparently large value of the saving in transmission losses to be effected by this small installation, it will be evident that its value is maximum when applied at the extreme end of the transmission system.

"(6) No tangible values can be assigned for the very important effect upon the regulation in line voltage at New Haven, which will be reflected in the cost and efficiency of operation in many ways.

"(7) The summary of the total savings as above, which will be effected is as follows:

Fuel	$ 78,750.00
Engine repairs	18,250.00
Engine and train wages	49,275.00
Transmission losses	16,500.00
	$162,775.00

If any criticism can be placed with regard to the matter of freight movement by electricity, I would say it would be in the matter of speed. The electric freight locomotives of the New York, New Haven and Hartford Railroad were built on specifications that permitted them to operate 1,500 ton trains on level track at 35 miles per hour. While the speed element, in as far as the New Haven service is concerned, may be entirely justified due to the very large ratio of passengers to its total service, thus permitting the freight trains to clear more promptly for passenger traffic, I would say that where the ratio of passenger service is less, the speed element for equal horsepower could be more valuably thrown into traction. For example, the New Haven locomotives have draw-bar pull characteristics that permit the operation of 3,000 ton trains by double heading. If these engines were reduced in speed by 35 per cent. and their traction increased by the same percentage, 4,000 tons would be the resulting double header trailing load which in turn would effect a large saving in train miles were these engines to be operated on a property less subject to passenger movement.

Perfection of equipment

Much valuable information has been developed in the past two years in connection with the handling of classification and switching yards by electric motive power. An idea as to the reliability of this class of service may be gained in saying that in 1,000,000 electric switch engine miles there has been but one failure.

The New Haven property includes in it two large switching yards: the Oak Point Yard containing 35 miles of track; the Harlem River Yard 25 miles. The introduction of the electric engine in these yards has increased the speed of the yard very greatly, and as near as I can gather from the yardmasters this increase of speed has been secured with a ratio of electric engines to steam engines replaced varying between 4 to 6 and 6 to 10.

Electricity in trunk line territory is now on a plane of consideration entirely different from the earlier days when it was new, untried and problematical. The future will see its agency playing a most important part in railroad competition.

While this paper has had particular reference to the New Haven and its increase of operation through the extension of its electrification zone, it would seem very inappropriate with so good an opportunity as this, not to say a word or two as to "system." I am willing to admit that I am a firm believer in the single phase system for trunk lines, the governing element in which, from an electrical standpoint, has been the transmission system. In a rigorous determination to adhere to this principle as correct for such a field, it has not been to gainsay the application of direct current in the territory where it rightly belongs; namely, where the governing element has been mass (trains under acceleration and breaking in close headway) in translation. As a citation of the two examples I would offer: (1) The electrification from New York to New Haven, and (2) the electrification of the New York subways.

In closing I would speak of two things which to my mind are most pertinent to the advance and successful utilization of electricity in the field of heavy traction.

The first is with reference to the mercury arc rectifier, and the second is in regard to effective electrical administration on the part of railroads electrifying.

The mercury arc rectifier

Having reference to the mercury arc rectifier, I feel sure that it will be of interest to state that there has been in commercial operation on the New Haven Road a car taking power from the 11,000 volt alternating current overhead contact system, and converting it into direct current for application to its propulsion motors. This car has been giving a most successful service, and the problem of the production and maintenance of the vacuum tube, through the agency of which the alternating current is converted to direct, has been electrically and commercially solved. What are the possibilities accruing from such a result? This can be epitomized in the statement that, if the economies in the transmission system of the single phase system justified the utilization of a heavier and less efficient motive power, today we are in a position not only to secure the economies gained in this transmission, but also to operate beneath the contact wires of such a system the more efficient and lighter direct current apparatus. As a concrete and practical application of this result, the present alternating current motive power now in use on the New Haven will be increased 25 per cent. by the application of the rectifier, and also permit it to enjoy simultaneously transmission and motive power facilities of the highest order of efficiency.

Administration and organization

With regard to administration, past experience with the engineering, construction and operation of a trunk line property of the character of the New Haven road has indicated with force the necessity of a very complete understanding of the difference between the operation of a steam and an electric property. In my judgment there will be no necessity for any general change in the administration or organization at present observed in steam operated properties to effect proper electric operation, but upon the minds of higher officials in the steam roads using or contemplating using this new mode of motive power, the fact should be impressed that the methods pursued in producing a ton mile of any character, passenger, freight or switching upon a steam basis must be abandoned when the draw-bar pull comes from electricity. The error of holding a steam master mechanic responsible for an electric engine mile of any character is patent, and equally patent is the error of holding a steam railroad shop man responsible for the maintenance and repairs of electric engines. Like electric power houses and transmission lines requiring the proper electrical talent, essentially necessary to the success of proper maintenance and inspection of electric motive power, are the electro-mechanics inside and outside of the shop. Such an arrangement does not change but merely affects the splendid railroad organization and administration that has come down to us. A successful operating result after electrification has been applied, is entirely dependent on a clear understanding and observation of this real difference between steam and electrical operation.

The Dealer and Contractor

Advantages to be Obtained by the Certification of all Electrical Workers

By A. C. Towne*

On November 24th Mr. F. A. Gaby, chief engineer of the Hydro-electric Power Commission of Ontario, sent out a circular letter, which reads as follows:

"The introduction of the Hydro-electric Power Commission's Rules and Regulations governing inside wiring has now been effected and many electrical inspectors are already appointed and such appointments will continue to be made until all electrical inspection is enforced as far as practicable throughout the Province.

"It is a well-known fact however, not only in Canada but all over the American Continent, that one of the greatest evils which confronts properly qualified electrical workers and contractors as well as manufacturers and dealers in electrical supplies is the competition from unqualified, inexperienced wiremen who are, owing to the absence of laws bearing on the subject, at liberty to undertake electric wiring or the sale of electric apparatus or supplies utterly regardless of their efficiency or safety.

"A large amount of this sort of work and the sale of such material is more or less effectually prevented where there is electrical inspection, but even in such places the Inspector is continually confronted with such conditions.

"In many of the American cities and districts legislation is now being enacted permitting only licensed electricians to install wiring or approved material to be sold. It has been suggested from time to time that such legislation be enacted in this Province, and before taking any further steps in this matter or suggesting any amendments to the present Act, it is the wish of the Commission to ascertain from people now engaged in electrical work the consensus of opinion as to the advisability of adopting measures similar to those now being introduced in other countries requiring that only licensed electricians be allowed to do electric work and that only material that bears the stamp of approval be permitted to be sold or used in this Province. Kindly let us hear from you and we would appreciate your comments or suggestions."

Plumbers and steam fitters must have a certificate or license before they can follow their trade, but anyone is allowed to do electrical work, so long as they can get their handiwork passed by the Underwriters.

When we pick up the papers and read that Mr. Jones, of ———— Street, was burned out last night, the probable cause being defective electrical wiring, probably the majority of us agree with the newspaper men, especially after seeing some of the jobs that are put over on the public.

Not many years ago the wiring was done by plumbers and fitters, and even at the present time, there are plenty of people that still think that our trade, which to my mind is the most important of all, does not call for any particular skill or experience. To offset this condition we must all work together to elevate the trade.

How many men in this city can handle 2,500 volt installations and get them passed? Still in this city there are approximately 1,000 men who are classed as wiremen or electricians (in the directory and telephone books), and the majority have settled their own classification.

The Unions throughout the States and here in Montreal are doing all they can to remedy this, but there is a weak point in this. From past experience the writer has found that the personal element enters largely into all Union matters and if "Bill Smith" is a good fellow and well liked, he will get through even if he does fall down on some things.

To remedy this we should have examinations carried out by competent men, both technical and practical, and guarded in such a manner that politics cannot enter.

A Model Ordinance

The Society for Electrical Development, of New York, in reply to a request, have forwarded a copy of "A Model Ordinance" drawn up by their Mr. Thos. Dwight, of the Engineering Department, who says that we must not consider this as voicing the Society's views as a whole, but his own opinions after a careful study of a number of successful ordinances now in force in various cities. The parts that apply to this subject are as follows:—

Section No. 3.—Any persons or corporations making application for permits to install any electrical material, must file with the city electrician, an affidavit that the work will be done by or under the supervision of an electrician duly licensed by the city of ————.

Section No. 4.—Any persons desiring to make application for permit or license to install wires or electrical apparatus, shall file with the city electrician a signed application, stating age, previous experience, etc., and shall have his application endorsed by two responsible citizens. It shall be the duty of the city electrician to appoint a time for his examination.

These examinations shall cover the same subjects for all applicants. The applicant shall submit to such examinations as the city electrician shall deem necessary. Upon satisfactory proof of his ability and payment of the regular fee, a permit or license shall be issued, which shall entitle the applicant to obtain permits to install wires or apparatus for the period of one year, providing however, that the city electrician may cancel said permit or license if the holder has violated any of the ordinances of the city.

Classifying the Men

The sub-dividing or classification will be a very difficult job and one that will require very delicate handling. Naturally each man will consider that he is as good as his mate and will want to be classed accordingly. It may be that this subdividing will tend to make specialists, but it will also keep the ambitious man keyed up to attain the highest class, from monetary reasons if from no other. They could be arranged as follows:—

First.—Men that can handle anything in the electrical

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line, and have done so, will naturally be first-class men.

Second.—Men that can handle small jobs on high tension but who are not posted on the technical part of the work.

Third.—Men who can handle conduit, and wiring on 600 volt.

Fourth.—Men who can handle house wiring and wiring repairs.

We should all endeavor to educate the public along these lines, as the average man thinks, "I can string up those two wires as well as anyone, and I won't hire a man for that," and as a rule he gets away with it, unless as a friend of mine did, he puts a short on the line and has to sit around in the dark until he can get someone that knows what to do, to clear it up for him.

The Screw Driver Electrician

This class is very numerous and in many cases does a great deal of harm, for when they have a job to be done, they think that $1.00 per outlet is high and look for some cheap man—and find him. Then they think that the $1.00 man has tried to do them, when all he wanted to do was to use good material, pay good wages and do a good job. We all have a certain amount of pride in a job we have done well, while if we have slighted the job, we want to change the subject as soon as it is mentioned. If the Government would enforce some examination it would eliminate some workmen but it would work out for the good of us all. We all know the Screw Driver Electrician and have seen his work. How some of it passes inspection has been a mystery to many, but it does, and remains a menace to life and property for years.

Coming back to the examination and what it should consist of, there is a diversity of opinions. Personally, I think that it should be left in the hands of a Board of Examiners, who should make the applicant show his practical knowledge, work out some theory and bring proof that he has worked three years at the trade. A general knowledge of the applicant would be of great assistance as he might be able to handle the practical end of any job in the country and still fall down on the theoretical end or just the reverse, and still be a good man. Provisions should be made for such cases.

It would also keep out a class, who although they are too old to be called "child labor" are too young to be put out on wiring jobs, as is being done in Montreal to-day. We have all seen boys from 12 to 15 years old, wiring flats, who do not know that there is such a thing as a fire risk, their only thought being to get the job passed and if they can put one over the Inspector, so much the better.

Approves Examination

In summing up the advantages to be obtained by the certification of all electrical workers we think that the examination would improve the standing of the good careful workman, both in the eye of the public and from a monetary standpoint as he would always have a demand for his service at a good rate of pay and it would also act as an incentive for his advancement. He would naturally want to get into the highest class, which would require careful study and a close attention to his work. It would eliminate the round peg in a square hole, as the poorer workman knowing that he could not get a certificate would be obliged to turn to some other work, for which he might be better fitted.

From the supplyman's standpoint it would be of great help, as it would cut out the man with his office under his hat, who uses material which has been taken from his previous employer and who is willing to take a job at any price. It would also mean that a number of cheap flimsy devices would disappear from the market, as all would wish to use the best material obtainable.

The contractors' men would be more careful, knowing that not only their jobs but also their certificates depended upon the quality of the work they did.

It would classify his men, help him in placing them, knowing what each man could do, without taking any chances of trying out and would reduce his overhead expenses, by reducing the supervision.

To the helpers or men learning the trade it would give them the opportunity of taking their examinations when they thought themselves competent, providing they could get two first-class men to sign their application.

In a reply to a request the Secretary of The Master Electrical Contractors' Association of Winnipeg, writes as follows:—

Winnipeg is Active

"The question of licensing of electrical contractors is a question which is being handled in so many different ways that it is a very difficult matter to put into writing, a clear and concise explanation that would agree with every person's views on the matter. We are striving for the licensing of all persons doing electrical work of any description, either contractors or electricians, catering to the public, on a basis of a substantial yearly fee, and a bond of not less than $1,000. The idea of a small fee will not eliminate the cause for which we have complaint. Licensing is necessary as a public safeguard against incompetent workmanship, against the person who takes work at a ridiculously low figure, and procures all the cash he can out of the job and then leaves the customer to finish the job. It would also be a great help to the city electrician's department as regards permits, etc., and lastly, it is a protection to the legitimate contractor as a guard against stolen material as there is no doubt that a large percentage of the material used by the Carpet Bag Man is stolen from the firm he was last employed by. One big point in which we receive the support of the wholesale houses, is that licensing and bonding will be of great assistance to them by reducing the possibilities of bad accounts."

Personally, I think that Montreal would be well to follow the example of Winnipeg in this matter. We have larger interests here than they have there, and should blaze the way for others to follow.

It will take time to work this out but it will pay in the long run, and we should all endeavor to convert some of our friends.

Personal

Mr. R. M. Worden, manager of the Brandon Gas and Power Company, Limited, is on a trip in Eastern Canada.

Mr. R. H. Parsons, Superintendent of Electrical Power of the City of Edmonton, Alta., for the last two years, has left on an extended holiday, part of which will be spent in England.

Mr. C. W. Colvin, engineer-in-charge of transmission lines of the British Columbia Electric Railway Company, was injured during a recent fire on Connaught Bridge. Latest reports are that Mr. Colvin is making satisfactory progress.

Mr. R. R. Matson has been appointed electrical inspector by the Hydro-electric Power Commission of Ontario, of the district north of Toronto extending as far as Midland and Penetang.

Mr. A. T. Smith, formerly superintendent of the light and power plant in Merritton, Ont., has been appointed electrical inspector of St. Catharines and the adjoining district, with headquarters in St. Catharines.

Mr. J. A. Shaw has been appointed electrical engineer of the Canadian Pacific Railway System. Mr. Shaw joined this company in 1904 as assistant engineer of motive power at the Angus shop, and was made electrical engineer of eastern lines in 1908.

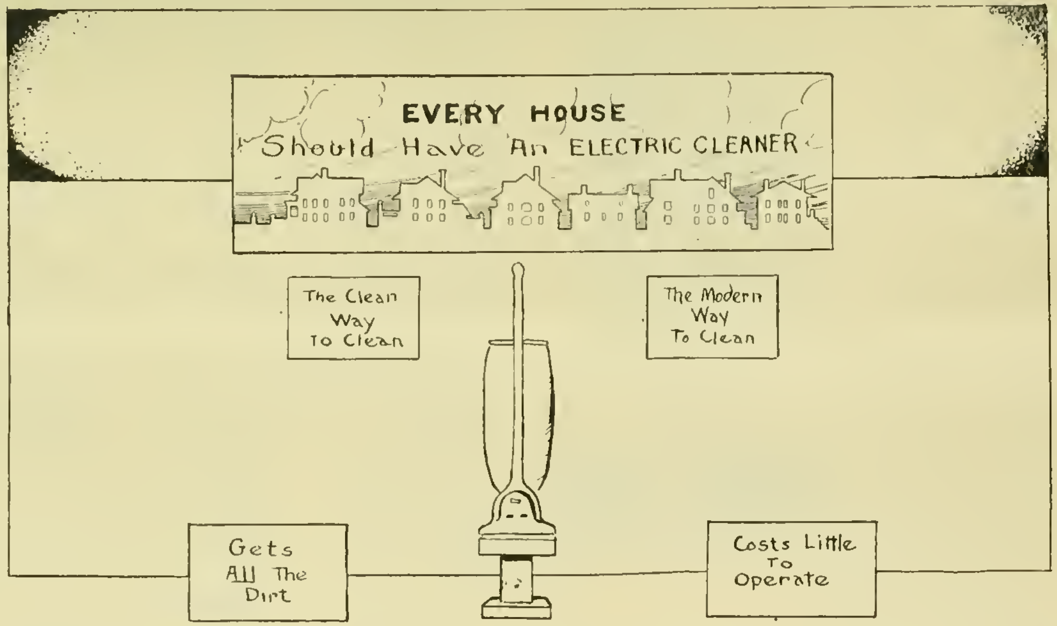
Window Display Suggestions*

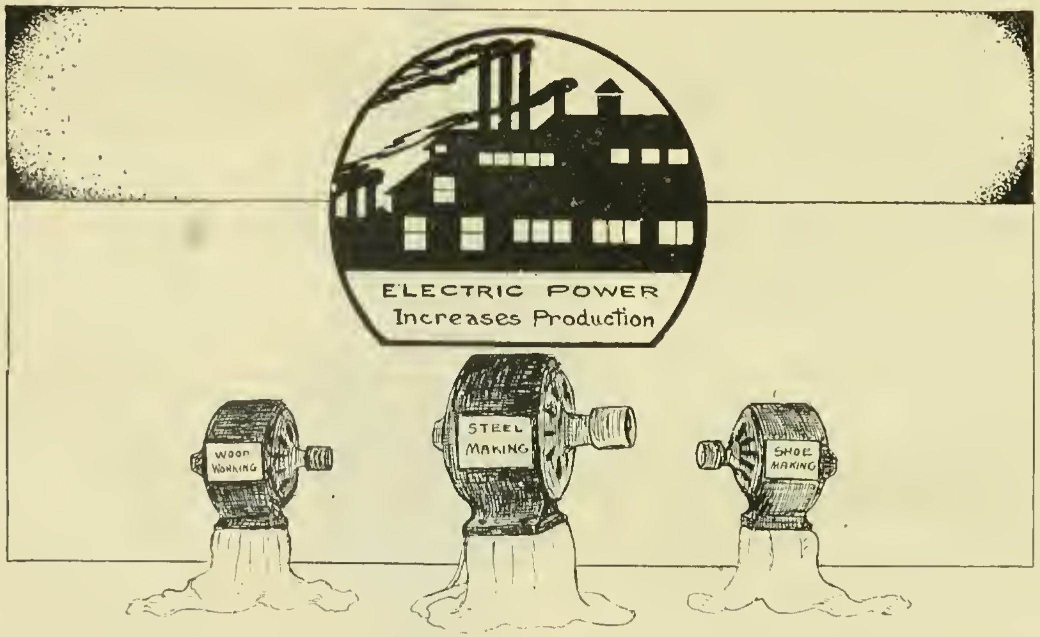
People often judge a business by the store front, so the appearance of the window displays has a much greater effect on the public than the average dealer realizes. It weighs more heavily than any other one thing in deciding prospects between his shop and the one across the street. As a rule people see no further than the surface, and think if the store front is unattractive the interior is the same.

Of the many things claimed for show-window displays, one thing cannot be questioned, which is that shoppers first look in show-windows for the things they wish to buy. Some people buy things because they need them, some buy because they think they need them, but most people buy because good window displays remind them of real wants and create wants that did not exist before.

If a dealer is not getting 100 per cent. value out of his show-windows, this is an exceptionally good time for him to change his method and see that he does get it. The good weather brings big throngs to the business sections to see what the dealers have to offer, and displays give direct returns in immediate sales.

* By A.J. Edgell, The Society for Electrical Development.





To secure the attention of the passer-by, there must be some feature that will catch the eye.

Displays with background features such as the illustrations accompanying this are of tremendous value in increasing the productiveness of the show-window. These can also be used in open backed windows by hanging them from the ceiling with fine wire.

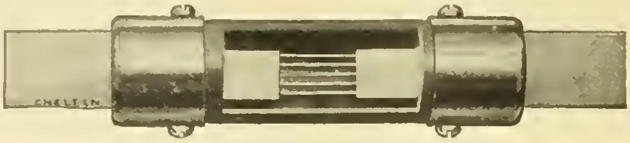
The feature used to secure the interest of the passer-by in illustration No. 1 is a large panel showing a row of houses. This is inscribed "Every house should have an electric cleaner." It can be obtained from a show-card-writer at small cost. Electric cleaners should be displayed and descriptive cards used with them. These cards should tell of the convenience of electric cleaners. Unless cards of this kind are used, people do not realize the many good features of such devices.

The second illustration shows a suggestion or use with electric motors for industrial power. A silhouette of a factory lettered "Electric power increased production," is the background feature for this display. Motors are placed on boxes draped with velour. Show cards, telling of instances where electric power has increased production, used with a display of this kind, aid materially in conveying the right thought about motors to the prospective user.

What's New in Electrical Apparatus

Chelten Enclosed Fuses

The Chelten Electric Company, Philadelphia, Pa., has recently marketed a new line of enclosed fuses. The fuse is of uniform rating, blowing in accordance with the Under-



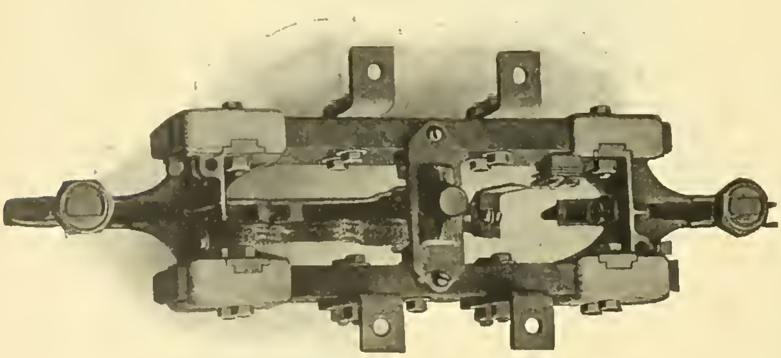
writers' requirements. At normal temperature it will carry indefinitely 10 per cent. greater load than rated capacity, being calibrated to blow uniformly at 17½ per cent. overload; this percentage being a mean between the standard

limits of 10 per cent. minimum and 25 per cent. maximum required by the Underwriters. These fuses are made in all standard sizes up to and including 600 amperes, in both the 250- and 600-volt types.

Automatic Section Insulator

Patent has been recently granted William Schaake, of the Westinghouse Electric & Manufacturing Company, on an automatic section insulator. These insulators are inserted in trolley wires where it is desirable to energize a section when the trolley passes on to it and to de-energize it when the trolley passes off. They are used extensively in mining installations where a branch is to be energized only when the locomotive is on that branch. Leakage losses and dangers of contact by persons passing under the trolley wire are thereby averted when the locomotive is not on the branch. Street railway companies sometimes use them in the same way.

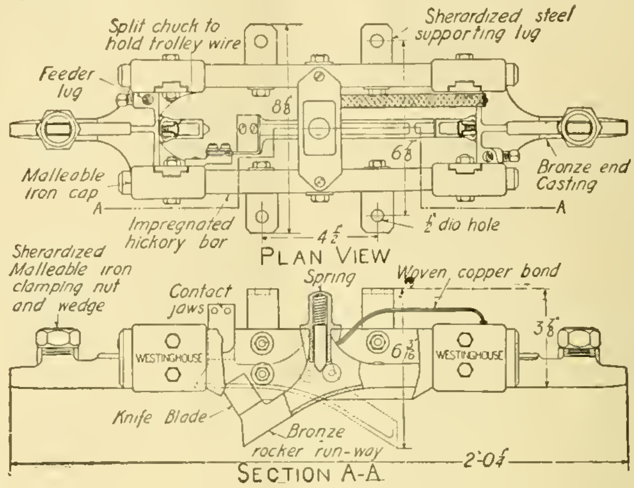
The circuit is opened and closed by a switch blade



Patented section insulator.

mounted on a rocker that the trolley operates. In one position the blade connects with copper contactors. In the other there is no connection. A brass plunger pressing against a steel roller gives a position centering action and prevents the rocker from remaining in an intermediate position. There is no arcing at the switch contact, because the rocker is always energized and the switch connection is always opened or closed while the trolley wheel is on the rocker.

Side bars of impregnated hickory take the stress. All metal parts are either sherardized or of bronze. Wedges are used to hold the trolley wire and an internally threaded chuck, like that used in the Westinghouse Cleveland splicer, supplements these. A flexible woven-copper bond carries current to the switch blade on the rocker. These insulators

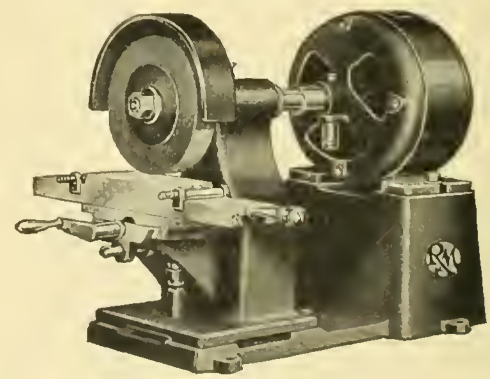


Plan and section of new insulator.

are manufactured by the Westinghouse Company and are the same automatic insulators that have been manufactured by that company for some time past.

Electric Driven Grinder for Preparing Test Samples of Rubber

The machine illustrated below has recently been developed by the Emerson Apparatus Company, 251 Causeway Street, Boston, Mass., for the purpose of preparing samples of rubber of absolutely uniform cross-section for tests of tensile strength. Its principal use is for preparing samples of hose lining for test. A section of hose several inches in length is slitted along its length, and the interior lining with its rubber backing is stripped from the fabric. This strip of rubber is cut to a uniform width of one-inch throughout a



New use for electric motor.

distance of three or four inches along the middle of its length. The strip is then strapped closely to the plate of the grinder, smooth side down, and held firmly in position by the two eccentric rolls. By means of the longitudinal, vertical and cross adjustment of the plate of the grinder, the sample may be quickly ground down to an absolutely uniform thickness throughout the length of the test section. The grinder is direct-driven by a 1-6 horse-power motor, manufactured by The Robbins & Myers Company, Springfield, Ohio.

Bull's-eye Indicator Receptacle

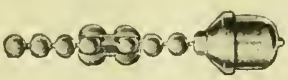
We illustrate herewith the new Hubbell Bull's-eye indicating heater receptacle, which is furnished ready wired complete with switch and plug receptacle. The plug is equipped with the new Hubbell T slot contacts, permitting the interchange of 17 different types of caps. The device is rated at 10 amps., 124 volts. It is designed for use with three gang wall boxes. Fig. 2 represents the Hubbell polarized motor plug. The composition cap with knife-blade contacts is designed to be permanently attached to electrical machines. The polarity arrangement ensures proper connection at all times. The body of the portable base is made of composition and the end brass covered, so that it is capable of withstanding hard usage. R. E. T. Pringle are Canadian agents.

Fig. 1.

Fig. 2.

Two Useful Devices

Spielmann Agencies, Regd., Read Building, Montreal, have placed two novel and useful devices on the market, which should appeal to the electrical contractor and dealer. They are the Malton splicing link and insulator for repairing, lengthening or insulating the chains of pull-sockets. To repair or lengthen a chain, the ends have only to be placed in the repair link, pressed with pliers, and the repair is made. The insulator is similarly attached by breaking the chain and slipping on the insulator. It is claimed that the devices ensure permanent protection against shocks. Being stronger than the chain, they will never pull apart. The links are made of tempered brass, and the insulators of special close grain fibre; warranted to insulate when damp against 5,000 volts: by actual test they will withstand over 10,000 volts. Many cities now compel the use of insulators in bathrooms, kitchens, concrete buildings, etc., and the manufacturers claim that not only do the Malton insulators provide a simple and inexpensive means of carrying out the regulations, but they afford complete protection against accidents caused by high voltages being thrown on the line through central station and main-line troubles.



Showing splicer in place.

Showing both splicer and insulator.

The Chinese railways have just placed an order with Griffiths Bros. & Company, London, England, for sixty tons of Ferrodor Rust-proof elastic paint. Twenty tons of this paint are to be shipped to Australia this spring. The Canadian agents are the Spielmann Agencies, Regd., Read Building, Montreal.

A Small Mercury Vapor Rectifier

It is no longer necessary for garages to charge automobile lighting batteries from large motor-generator sets or direct current supply circuits of comparatively high voltage, and thereby waste most of the energy in resistances in order to cut the voltage down to a value suited to the battery. The many types of batteries used on Ford cars, and the large number of batteries charged from cars having their own generators, which, however, occasionally need an extra charge, can now be charged up at a very low cost and with very little trouble.

The Westinghouse Electric & Manufacturing Company have recently placed on the market a small mercury rectifier charging outfit, known as the modified type E, specially designed to suit the needs of public garages that have a number of gasoline automobile lighting and starting batteries to charge each night. It is a simple and compact little unit arranged for mounting on the wall at whatever point is convenient. It consists of a cast iron wall bracket on the front of which is a small slate panel having mounted thereon the necessary switches and connections. The mercury bulb is mounted behind the panel where it is well protected, and is tilted for starting by means of a knob on the front of the outfit. Back of the bulb and mounted on the wall bracket are the transformer and reactance coil.

The outfit is designed for charging one 3-cell battery at a time or a considerable number of such batteries in series. Provision is also made for charging one or two single cells which is particularly advantageous if there happen to be one or more low ones present. Both 5 and 10-ampere outfits are available for charging 1 to 18 or 1 to 36 cells, and all outfits are designed for operation on either 110 or 220-volt, 60-cycle circuits. Simple link connections are provided for adjusting the outfit to suit either voltage.

The adjustments to suit the different numbers of cells to be charged are all accomplished by changing the transformer connections, and no energy is wasted in series resistance. All adjustments are easily made by means of simple dial switches, and the control of voltage and current is so flexible that practically any desired adjustment may be obtained. It is easy to adjust for a tapering charge, such as is suited to lead cells, or for the more constant current charge which is best for Edison cells. In both these cases, the outfit does not need to be touched once the charge has been started. Where an attendant is always present, however, the dials can be reset at any time in order to keep the current constant or make the charge follow any desired schedule.

When a number of batteries are to be charged, they are connected in series, as this is the simplest and most efficient method. As each battery becomes fully charged it is disconnected and the charge continued on the rest with a lower dial setting to take care of the smaller number.

Provision is made for mounting a d. c. ammeter on the panel when desired. No provision is made for a voltmeter, as the voltage of a number of batteries in series in different stages of charge would be meaningless. It is necessary to measure the voltage of each battery separately, and a portable voltmeter is best for this purpose.

Such an outfit will fill a long-felt want and make the charging of lighting batteries really profitable to garages instead of being an expensive but necessary service to regular customers which is frequently conducted without any profit, oftentimes at a loss, owing to the energy wasted in resistance.

The average hourly cost of charging with these outfits at a 5c. per kilowatt-hour rate for current is about $0.012 for 6 cells, $0.025 for 18 cells and $0.048 for 36 cells using the

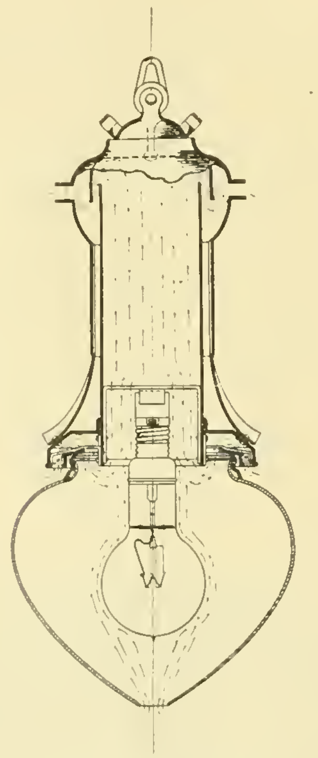
10-ampere outfit. With the 5-ampere outfit, the hourly cost for current is correspondingly reduced.

Bulb trouble is practically unknown, due to the low d.c. voltage and the high factor of safety in the new design bulbs used for the first time with these outfits. The design of the transformer and the starting scheme on these outfits are both entirely unique, making possible a flexibility of control and an ease and positiveness of starting over a wide range of cells and line voltage that would have been impossible with any of the schemes formerly in use.

Similar outfits for the use of the car owner who desires to charge one or two batteries at home are also available.

Converting the arc lamp to a "nitrogen" container

The introduction of the recently developed nitrogen lamp and its increasing popularity for street and commercial lighting has made necessary a new design of container for its successful and efficient operation. There were two ways of meeting these requirements, redesigning and converting the existing arc lamps into suitable containers, or the purchase of entirely new equipment. Of the many advantages offered by the first mentioned method the most important was that of economy, and after many tests and considerable experimenting, The Metropolitan Engineering Company, of New York, claim that they have found it possible to convert the arc lamp to a Type "C" lamp container at considerably less than



Cross-section of unit.

that which would be charged for new equipment. From an operating standpoint there were two factors to contend with, first, the absolute elimination of rain water in contact with the lamp bulb and second, so housing or enclosing the lamp that leading in wires in the lamp would be operated at the lowest possible temperature. The first is accomplished by the introduction of baffle plates within the housing and so designed as to prevent the entrance of water and still provide sufficient clearances to permit air stream flow with the least possible resistance. As is well known, with this type of lamp when burning tip down, the lamp base and all that section of the lamp within the cylindrical formation are subjected to comparatively high temperature and it was found necessary to so design a unit as to operate this particular section at the lowest possible temperature. The final result is a unit shown in cross-section in Figure 1, where it will be noted that the entire design takes the form of a chimney with cold air entering beneath the lamp at the bottom of the globe which rises rapidly and becomes heated after enveloping the lamp bulb, passes upward with considerable velocity and in so doing induces a volume of cold air to enter above the top of the globe as illustrated. This particular cold air stream entering above the globe top and being directed against those lamp parts liable to high temperature causes them, it is claimed, to actually operate at a temperature lower than would obtain if the lamp burned in free atmosphere.

Power Commission Act, 1915, Respecting Electrical Wiring and Equipment

Section 37 of The Power Commission Act as amended by Sections 6 and 7 of The Power Commission Act, 1914, is repealed and the following substituted therefor:—

The Commission may make regulations as to the construction, operation and inspection of the works, plant, machinery, apparatus, appliances, devices, material and equipment for the transmission, distribution, connection, installation and use of electrical power or energy by municipal corporations, and by any railway, street railway, electric lighting, power or transmission company, or by any other company, firm or individual transmitting, distributing, installing or using electrical power or energy or whose undertaking, works or premises are connected with any plant for transmission or distribution of electrical power or energy, and the Commission may impose penalties for the breach of any such regulations.

The Commission may at any time order the installation, removal or alteration of any works, plant, machinery, apparatus, appliances, devices, material or equipment as in the opinion of the Commission may be necessary for the safety of the public or of workmen or for the protection of property against damage by fire or otherwise.

The Commission may appoint inspectors for the purpose of seeing that the regulations and orders of the Commission made under the authority of this section or of any provision of this Act are carried out, may fix and collect the fees to be paid by any corporation, company, firm or individual upon any inspection made under the regulations or by order of the Commission, and may provide for the payment of the remuneration, travelling and other expenses of the inspector out of the fees so collected or out of the funds appropriated for carrying on the work of the Commission.

(2) Where prior to the passing of this Act an inspector has been appointed under Section 37 of The Power Commission Act and the amendments thereto for any municipality or for two or more municipalities, such inspector shall remain in office and shall continue to perform the duties imposed upon him by the regulations of the Commission until a direction in writing has been given by the Commission to the clerk of the municipality or the clerks of the municipalities for which the inspector was appointed that he shall cease to act as such inspector and shall account for and hand over to the municipal corporation or corporations by or for which he was appointed all fees, books, accounts, and documents in his possession as such inspector.

(3) Upon direction being given by the Commission as provided in sub-section 2, every by-law providing for the appointment of an inspector or inspectors for the municipality or municipalities and defining the qualification and duties of such inspector or inspectors shall be deemed to be repealed and of no further force or effect.

The Toronto Suburban Railway Company have abandoned their rights to build and operate street car lines on Pacific Avenue, Keele Street and Annette Street.

Successful Annual Dinner

More than 150 were present at the annual dinner and smoker of the Century Engineering Club, an organization of the employees of the Century Electric Company, St. Louis, Mo., held in the banquet room of the American Annex Jovian Hotel May 4, 1915. The officers and directors of the company were guests of honor. The program for the evening was of unusual interest. Mr. E. S. Pillsbury, President of the company, addressed the club on "Employees as Stockholders," a subject quite apropos since at least one-third of the employees are stockholders. Mr. R. J. Russell, secretary and sales manager, spoke on the sale of "Century" products in the United States and foreign fields. This organization during the past year has directed its efforts along educational and co-operative lines.

Hydro-Electric Radiation, Limited

Hydro-Electric Radiation, Limited, has been incorporated with capital stock $500,000 and head office in Toronto. It is understood that this company is formed to promote the manufacture of a new type of electrically-heated water radiator.

Change of Address

Franke, Levasseur & Company, Limited, wholesale electrical supplies, have opened offices and showrooms, with over 15,000 sq. ft. of floor space, at 150 Craig Street West, Montreal.

Escaped the Wild Beasts

The many friends of Mr. S. L. B. Lines, president and general manager Chamberlain & Hookham Meter Company of Canada, who with Mrs. Lines was a passenger on the Lusitania, will be rejoiced at the assuring cable from London, "Both safe and well."

Mr. Hoult is Manager

Mr. W. Hoult, B.Sc., M.I.E.E., has been appointed general manager of the Siemens Company of Canada, Montreal, in succession to Captain C. A. Ablett, who is now in England with the object of joining the Imperial forces. Mr. Hoult was previously chief engineer with the company, and prior to coming to Canada was assistant manager of Siemens Bros. Dynamo Works, Limited, Manchester, England.

Will Build Dam at La Loutre

The Quebec Streams Commission are calling for tenders for the construction of a dam, 1,720 feet long, 2½ miles above the falls, at La Loutre Rapids. It was originally intended to build and equip a power house, but it has now been decided to abandon this part of the scheme and to develop power, at a later date, at a point ten miles lower down the St. Maurice River.

Authorized Capital Increase

At the annual meeting of the Western Canada Power Company, held in Montreal, on May 7, Mr. C. H. Cahan, K.C., the president, stated that the B. C. Electric Company will take 3,300 more horse-power in September. Another one of their customers is increasing his order by 500 horse-power, and the Imperial Oil Company will take an additional 800 horse-power. The shareholders passed a resolution authorizing the increase of the capital stock to take care of some short notes which fall due in March.

Mr. McNaughton Injured

Major Andrew McNaughton, electrical engineer, and one of the teaching staff of the electrical department, McGill University, was among the wounded at the battle of Langemarck. Major McNaughton left Montreal in command of the local detachment of the 2nd Canadian Field Artillery. For several years he was in command of the 3rd Battery of the 6th Brigade. Capt. W. C. Brotherhood, of Montreal, is reported missing. He is an electrical engineer, and was in partnership with Mr. Archibald as electrical engineers and contractors under the name of Archibald and Brotherhood. Mr. Archibald has obtained a commission and is leaving for the front.

Trade Publications

Diesel Oil Engines—Bulletin No. 1532, by the Canadian Allis-Chalmers, Limited, describing their Diesel type oil engines, with illustrations.

Display Windows—The Westinghouse Electric & Manufacturing Company have just issued their first number of the show window calendar electric window display service to be issued every month by that company for assisting electrical dealers and central stations in selling Westinghouse electric ware. The first issue contains a very helpful suggestion on the arrangement of a seasonable window display.

Westinghouse—The Westinghouse Electric & Manufacturing Company have issued bulletins on the following subjects: switchboards for alternating current power stations; radiator type transformers for the New Haven system; Westinghouse railway lightning protection and "Ready by the clock," an interesting little booklet describing the electric ranges manufactured by this company.

New Books

"The Electric Railway Handbook"—Richey (McGraw-Hill Book Company, New York City). Reviewed by E. V. P.

To collect as much information as the author has done into a compact 16mo. volume only 1-in. in thickness is no mean achievement, and few will be found to criticize Professor Richey's work on account of its sins of omission. The book is avowedly a compilation and nothing more so that the reader seeking new treatment of electric railway problems need not be disappointed. In some respects the author's ideal of completeness has carried him too far; the early train resistance formulas of Wellington, Baldwin and others; data of the GE 800, GE 1,000, GE 58, and Westinghouse 12A motors and the trolley collecting device of the Oerlikon Company are of little more than historic interest. Perhaps a little less space might have been devoted to fancy methods of speed-time curve analysis and rather more to the exposition of the simple "point to point" construction.

Events move so fast in electric railway work that it is difficult for a book of this kind to be right down to date. We note that the series fan system of motor ventilation introduced by the General Electric Company in 1911 is described but the new multiple fan construction and the Westinghouse "500" type of ventilated motor are not mentioned. Characteristic curves of thirty direct current railway motors are given but none of these relates to a field control type of machine or to 1,200 volt operation.

The motor wiring diagrams (pp. 294 et seq.) and the controller diagrams are particularly good and useful; more of these might have been included to advantage. Trucks and car bodies are very fully dealt with but locomotives on the other hand are relegated to eight pages comprising somewhat meagre information of no very recent origin.

This is an age of economics and engineering is 100 per cent. dollars and cents, one therefore looks for plentiful cost data in a technical handbook. In this respect the volume is lacking and a chapter of estimating information including figures for construction and operating costs would be a valuable addition.

Current News and Notes

Battleford, Sask.

Applications were received up to May 8th, for the position of town electrician.

Blenheim, Ont.

Hydro-electric by-law carried in Blenheim on May 10th by a majority of 236.

Calgary, Alta.

The Alberta Hydro-electric Power Company announce that they will shortly proceed with the construction of a series of six dams and power houses at a cost of two million dollars. A. W. Ellson Fawkes, consulting engineer, 518-9 P. Burns Building, Calgary.

The award of the Board of Arbitration appointed to settle the wage dispute between the city and the electrical workers, has placed the members of the maintenance gang on a permanent monthly hire basis of $105, which is subject to a present reduction of 10 per cent. The construction gang will continue on a $4.50 a day basis with 10 per cent. cut.

Dryden, Ont.

Members of the engineering staff of the Hydro-electric Power Commission of Ontario are collecting data on the Wainwright water power to be used for municipal purposes.

Edmonton, Alta.

According to the report of the Power Plant Superintendent, the municipal electric plant of the City of Edmonton has just completed a very satisfactory year. It has been possible to reduce the cost of power to their utilities and to lay aside a surplus of $87,817 towards the reduction of capital after all interest and sinking fund charges have been met. The following comparative figures will give a good idea of the reduction in charges that have been made to the various other branches of the city's utilities: Light Department—Cost reduced from 3.345c. in 1913 to 3.1c. in 1914. Street Railway Department—1913 rate 2.282c., 1914 rate 2.0c. The consumption of energy by the Street Railway Department was reduced some 14 per cent. but this was practically offset by an increase of 10 per cent. in the Lighting Department.

The report goes on to say that since 1912, 16,000 kw. capacity in a.c. machinery as well as 750 kw. in d.c. have been installed. However, with the increased demands on the station the margin of power is small and early in 1914 further contracts for 6,000 kw. generating equipment were let. The installation of a new unit has been deferred, however, owing to financial conditions which have considerably reduced the demands on the existing plant.

The J. D. McArthur Company, Limited, builders and owners of the Edmonton, Dunvegan and British Columbia Railway and the Alberta and Great Waterways Railway, have erected a saw mill at their terminal in Edmonton said to be the largest in Alberta. It has a capacity of 300,000 feet B.M. in 24 hours. In connection with this mill two power houses have been built. One is steam exclusively; it has a capacity of 300 h.p. and is used to run the saw mill proper. The other plant is electrical and has been built with a view to using part of the power to operate the planing mill and the railroad shops. These two houses are built side by side. The boilers burn the sawdust and a certain amount of slabs and edgings from the mills. The sawdust is carried overhead by a chain carrier, dumped over the fire-box of the boilers and fed to the boilers through a trap door. The engine driving the electrical machinery has a capacity of 320 B.h.p. running at 85 r.p.m. This engine drives two 125 kw., 600 volt, three-phase, 60-cycle, 120 r.p.m. generators by means of a clutch pulley and belt, the plan being to leave one generator idle when not required.

Fort Frances, Ont.

The town council recently passed a resolution that the Hydro-electric Power Commission of Ontario prepare a report on the possibilities of Sand Island Falls as a supply of electric power.

Fort Saskatchewan, Alta.

The Provincial Government are installing a 125 kw., d.c., generator at the new penitentiary building in Fort Saskatchewan, Alta. This will be sufficient to furnish all the light and power required in and around the building.

Fredericton, N.B.

A special committee of the Board of Trade was recently appointed to consider the question of obtaining a further supply of power for manufacturing and other purposes. It is understood the committee has already received offers from different engineering firms and that they are in a position to make a report.

Harrison, Ont.

The town of Harrison will join with a number of neighboring towns in negotiating for a supply of hydro-electric power. It is proposed to tap the main line near Mitchell and supply also Milverton, Atwood, Listowel, Palmerston, and Clifford.

London, Ont.

The official opening of the London & Port Stanley Railway System has been postponed to June 19th.

Montreal, Que.

Mr. G. F. Perkins, president of the Perkins Electric Company, Limited, Montreal, is on a business visit to the West. This is one of Mr. Perkins' periodical trips, which are always productive of good results.

The Montreal offices of the Canada Wire and Cable Company, Limited, and Moloney Electric Company of Canada, Limited, have been removed from 401 Lake of the Woods Building, to 501 Merchants Bank Building.

R. E. T. Pringle has removed from the New Birks Building, to 216 Bishop Street, Montreal.

The Wise Electric Company, Montreal, have dissolved; the business will be continued by Mr. Louis Fortier.

Messrs. Roderick J. McLean and Thos. R. Barker have registered as mechanical and electrical engineers in Montreal.

Messrs. Alexandre Dorais & Cie, electricians, have registered in Montreal.

Sergeant Albert V. Hardwick, of the 14th Battalion, of Montreal, who was killed at Langemarck, was traffic accountant of the Marconi Wireless Company; he was the pos-

sessor of the Albert Medal presented for bravery in rescuing a woman who fell on the track at a London railway station. Bombardier John F. Forman, of Montreal, reported wounded, is the youngest son of Mr. John Forman, of the well-known electrical supplies firm, Craig Street West, Montreal.

Port Dalhousie, Ont.

Town electrician Sevigny has resigned his position in order to accept a position in another town.

Preston, Ont.

Extensions to the fire alarm system were recently tested out and found to work satisfactorily.

Riceville, Ont.

The South Plantagenet Rural Telephone Company, Limited, Riceville, Ont., has obtained a charter.

Saskatoon, Sask.

Notwithstanding the reductions in the rates for power and light, and the falling off in the revenue, a surplus of $1,500 for the power house is shown by the monthly report. An interesting feature of the report is that the cash collections last month were approximately $4,000 greater than the revenue, which shows that the amount of outstanding accounts is being rapidly reduced.

St. Catharines, Ont.

The hydro rates for domestic lighting have been reduced and now stand as follows: service charge of 3 cents per 100 sq. ft. plus meter charge of 2¼ cents and 1⅛ cents, according to the general scheme. Commercial lighting rates are 5 cents for first 30 hours' use per month, 2¼ cents for the next 70 hours' use, and .15 cents for the balance.

Shoal Lake, Man.

The Shoal Lake Electric Light Plant was started up on Wednesday, April 21st.

Stratford, Ont.

The council will raise the question with the Bell Telephone Company of placing all future lines of the company underground.

Sydney, N.S.

The directors of the Cape Breton Electric Company have declared a semi-annual dividend of 3 per cent. on the preferred stock, and a dividend of 1½ per cent. on the common stock.

Thamesville, Ont.

A by-law was submitted to the ratepayers on May 10th authorizing the town council to enter into an agreement with the Hydro-electric Power Commission for a supply of energy for light and power; carried by 124 to 2.

Toronto, Ont.

The Hubbell Electrical Supply Company, of 75 Bay Street, recently suffered loss by fire.

The Toronto Hydro-electric Commission are building a new sub-station at the corner of Gerrard Street and Carlaw Avenue. A section of the building will be designed for a branch hydro-electric shop.

Vancouver, B.C.

A resolution was passed by the city council at a recent meeting, authorizing the fire and police committee to investigate a number of water power sites with a view to development for city supply.

City electrician Fletcher, following the disapproval of certain charges made by employees and former employees against his department, has been given absolute authority in the engagement and dismissal of employees and in the carrying out of the work of his department.

Victoria, B.C.

A letter was recently received by the city council from Roderick Mackenzie, London, England, pointing out that the competition of the jitneys with the B. C. E. R. system would have a tendency to depreciate all such properties in the eyes of the British investor, who, in the past, has so liberally supplied us with funds for promoting such enterprises. We believe this is a viewpoint worthy of the most careful consideration by our different governments.

Winnipeg, Man.

Public Utilities Commissioner Robson has issued a memorandum, which practically relieves the Winnipeg Electric Railway Company from the necessity of building extensions which had been proposed in various quarters. The Commissioner finds that the conditions under which the company is at present operating, caused chiefly by the jitney competition, have so reduced their earnings that it would be unreasonable to ask them to make these further expenditures. The following extract from the memorandum is of interest:

"The street railway company in ordinary times, and particularly before recent competition, was making such earning that it might carry further financial load and still ensure a fair return upon the value of the undertaking. But from the figures showing the reductions, due somewhat no doubt to financial depression, but primarily to the automobile competition, there is not now such a revenue that a fair return on the value of the property exists.

"There is evidently no contractual obligation to build the new lines, and because of the shrinkage just referred to the obligation under the law does not exist. So that nothing can be done in present circumstances towards enforcing the construction of these new lines."

Electric Taxicabs in Numerous Cities

(Continued from page 27)

soon do the same, and it will not be very long before you will see a regular system of electric taxicab service in every good-sized city in the United States."

Mr. McDowell is amply justified in his enthusiasm for the electric taxicab. In various recent tests, which the writer has observed, the electric taxicab proved its ability to pass through the most congested parts of New York with far greater ease than the average gasoline taxi. On Fifth Avenue, where traffic regulations demand constant stopping, the performance of the "electric" was admirable. It responded readily to the driver's touch and started as quietly and easily as it stopped, picking up and getting under way in remarkably short time.

The taxicab development itself, not only represents the introduction of thousands of electric vehicles, but it also means that the influence which the successful operation of these taxis will exert on the general use of introduction of electric vehicles, especially for passenger service, will be enormous. Practically all the thousands of persons using the electric taxicab will in a very direct and practical manner learn to appreciate the capabilities of the electric vehicle, all of which will very considerably stimulate their sale. Anyone after riding in an electric taxicab a few times, could not help but be forcefully impressed with its reliability, safety, ease and economy.

Mr. George D. Archibald, city engineer of Saskatoon, has also been appointed superintendent of the municipal street railway system.

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Generation Transmission and Application of Electricity

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Proper Lighting of Schools

Statistics gathered over a wide range in the United States show that upwards of ten per cent. of their school children have defective sight. Similar data is not available in Canada, but it is entirely reasonable to suppose, considering the fact that we average much less daylight, that our percentage is certainly not lower than this.

This means that at least ten per cent. of our children are operating under a big handicap and that perhaps two or three years are being added to the length of their school life —or more often taken from them—and further, that these children leave school still with this great handicap of poor sight and so, all too poorly equipped for their life's work. Quite aside from the humanitarian point of view, does it pay the state, economically speaking, to allow these conditions to exist, without making every effort and using every known means to remedy them?

The trouble in the majority of cases is that the people who handle these matters are ignorant of the principles underlying the correct installation and use of lights. The most elaborate system of prevention is used, for example, with regard to measles and all other similar little ills which properly come within the sphere of a medical practitioner, but with regard to the eyes, the "preventive" phase has not been appreciated. In a few exceptional cases where this matter has received a certain attention, it has been handled by architects, building inspectors or committees and what not, where the chance of a proper system being installed is just one out of a total which represents the number of ways it may be done wrong.

Our neighbors to the south are laps ahead of us in the matter of conserving the energies of our youth through the proper care of their eyes. As one example, the universities are making extensive practical tests and recently Dr. Ferree, of Bryn Mawr, published the results of a three years' research on eye fatigue, comparing various systems of illumination. Dr. Ferree shows that eye strain with good daylight is less that with any other source or system of illumination. Second (a good second, too, according to his figures), came the purely indirect system. Down in the third place comes semi-indirect, with direct lighting last.

Now, if these figures are correct, that is, if purely indirect lighting causes less eye fatigue than any of our other systems of illuminataion, that surely is the kind of lighting we ought to have for our boys and girls with defective sight. If we, as grown-ups, do not choose to use this system, all well and good—that is our own business. But what right have we to force a wrong system on a defenseless and defective child, who has neither the knowledge nor the authority to protest

So far as we know, this statement of Dr. Ferree's has gone unchallenged, but the matter is one of degree in any case. There is a growing need for the importance of lighting in our schools (as well as our homes, where much of the eye trouble is further aggravated), and the matter can only be remedied by people who appreciate and know how to apply the remedy. A layman has no more right to meddle in this case than in a case of smallpox. It is as much a specialist's subject as medicine, less highly developed as yet, but scarcely less important. When school board officials admit their ignorance of illumination matters and call in properly qualified illuminating engineers, then—and then only—will our children reap the fullest benefit from our somewhat elaborate and expensive system of book education. Who will deny that the conservation of our eyesight, affecting ten per cent. or more of our population, ranks in equal importance at least with our forests, our water powers, or our minerals?

Cost of Constructing a Short Transmission Line

With the extension of central station service into rural territory the construction expense of moderate voltage transmission lines becomes of interest. The accompanying cost data are taken from the Electrical World's report of the construction sheets of a Massachusetts central station which recently built an 11,000-volt single-phase transmission line across a portion of Cape Cod, 8.1 miles long, pole location rights being secured from real estate owners en route:

539 35-ft. poles, at $6	$3,234.00
1,204 Victor insulators, at 20 cents	240.80
539 pairs braces, at 26 cents each	140.14
11,843 lbs. bare copper wire, No. 4, at 16.75 cents	1,983.70
Carting poles	650.00
130 guys, at $1.14	148.20
424 lbs. No. 6 bare wire, at 18 cents	76.32
1,095 two-pin cross-arms, at 40 cents	438.00
2,190 1½-in. by 12-in. locust pins, at 4 cents	87.60
2 transformer towers	348.00
5 11,000-volt lightning arresters, at $43.50	217.50
2 11,000-volt air-break switches, at $100	200.00
1 2,300-volt oil switch	89.20
Right-of-way	345.00
Freight	183.00
Labor	4,800.00
Total	$13,181.46
Per mile of line	$1,620.00

The company obtained the permits for running the wires and also for the pole locations, the erection work being by contract. The contractor trimmed all poles, which averaged

125 ft. in spacing. Poles were head-guyed every half-mile, all guys being provided with porcelain insulators, and every twelfth pole was double-armed. Tree trimming was done by the contractor.

Big Staff Organized to Handle "Electrical Prosperity Week" Campaign

Apparently nothing is to be left undone to make the U. S. Electrical Prosperity Week campaign one of the greatest trade movements in history. The Society for Electrical Development, which has charge of the campaign, has just added to its staff of experts on general publicity, advertising and sales management. The following list will give a general idea of the thoroughness with which this campaign is being organized: Mr. John T. Kelly is editor of the Electrical Prosperity Week campaign news bureau; Mr. C. Ridderhof, recently advertising manager of the Hotpoint Electric Heating Company, will handle the advertising work. Mr. J. A. Randolph will prepare the trade press articles on the industrial power application of electricity. Miss Grace T. Hadley will be household editor of the society's Department on Home Economics. Mr. A. J. Edgell will handle the details of the illumination end of the big campaign and the co-operative work among merchants' and civic associations; Mr. H. W. Alexander will have charge of all publicity and sales work, and Mr. J. M. Wakeman, the general manager of the Society for Electrical Development, will have entire charge of all the details of the campaign, under the direction of the society's board of directors.

It is announced that complete plans of the campaign will be made known within a few days and that an effort will be made to place in the hands of every one interested in the movement, a booklet explaining what it is expected will be accomplished and how this will be done. The week of November 29th to December 4th is expected to be the biggest sales week ever known in the history of the electrical industry.

Mineral Production Report

The Department of Mines for Canada have just issued their annual report on the mineral production of the Dominion during the calendar year 1913. The report is the work of Mr. John McLeish, B.A., chief of the Division of Mineral Resources and Statistics.

No commercial ores of aluminium have yet been found in Canada. It is imported in the form of bauxite from France, Germany and the United States by the Northern Aluminum Company and treated at Shawinigan Falls, where a wire mill for the manufacture of aluminium wire and cable is also operated by this company. This is the only Canadian firm manufacturing aluminium.

The imports of aluminium oxide in 1913 amounted to 15,352 tons, of which 6,507 tons were exported in the form of ingots, bars, etc.; aluminium products to the value of $8,203 were also exported.

The total production of copper in Canada during 1913, estimated on the basis of smelter recovery from ores treated, was 76,976,925 pounds. This represents a slight decrease as compared with the production of the previous year, which was the largest on record. The average price in New York for the year was 15.269 cents per pound. More than half of this came from British Columbia, which accounts for 45,791,575 pounds. Ontario produced 25,885,929 pounds; Quebec, 3,455,889 pounds, and all the other provinces less than 2,000,000 pounds.

No production of tungsten is reported during 1913.

The Late Dr. Pearson

Dr. F. S. Pearson, one of the best known figures in the electrical engineering and financial world, was one of the victims of the sinking of the "Lusitania." Dr. Pearson is best known in Canada through his connection with Sir Wm. MacKenzie in a large number of electrical enterprises. At the time of his death, he was President of most of the Mexican, South American and Spanish enterprises in which Canadian capital has been chiefly interested, as, for example, the Mexico Tramways Company, including the Mexican Light & Power Company; the Brazil Traction, Light & Power Company, including the Rio de Janeiro Tramway, Light & Power Company, and the Sao Paulo Tramway, Light & Power Company; and the Barcelona Traction, Light & Power Company. Dr. Pearson's engineering firm was also frequently consulted in connection with electric railway and electric generating and transmission problems at various points in the Dominion. He was a member of the Institution of Civil Engineers, of London, England; of the American Society of Civil Engineers; the American Institute of Electrical Engineers; the American Institute of Mining Engineers; the American Society of Mechanical Engineers; the American Association for the Advancement of Science, and the Society of Naval Engineers. He was born at Lowell, Mass., in 1861.

Water Power Resources of Nova Scotia

Public interest in the question of water power development, use and regulation, is rapidly becoming widespread throughout Canada. Nearly every Province in the Dominion now enjoys the advantages of adequate water power administration, and Government organizations have fairly well covered the Dominion with water power and water resource investigations.

The most recent Government water power investigations are those covering the Province of Nova Scotia by the Nova Scotia Water Powers Commission. This Commission was created about a year ago, and has been fortunate in being able to make a co-operative arrangement with the Dominion Water Power Branch, covering the physical investigation of the water resources of the whole Province. Preliminary arrangements for this investigation have been made and the work is already well in hand. For the present season it will be confined to the more important power sites in the Province, but will gradually be extended to cover every power stream.

Montreal to San Francisco

On January 25th, with befitting ceremony at Boston and New York, telephone service was inaugurated between Boston, New York and San Francisco, an account of which has appeared in the "Electrical News."

At that time the officials of the Bell Telephone Company of Canada informed the press that this service would shortly be extended to the important centres in the Dominion and gradually through their territory. This promise has now been fulfilled with respect to Montreal and Toronto and their immediate environs.

On May 11th, representative citizens of Montreal and members of the press gathered in the office of Mr. C. F. Sise, Jr., general manager of the Bell Telephone Company of Canada, and in a quiet way service from Montreal to San Francisco was inaugurated, conversations with officials of the Canadian Exhibit at Panama-Pacific Exposition and others being carried on.

The delight and amazement at the clearness and loudness of the conversation carried on was indicated by the expressions and comments of those present. Con-

versations were possible with no more effort than if the persons speaking were in the same room.

Since Dr. Bell produced his first telephone there have been introduced seventy-three transmitters, fifty-three of which have appeared since 1877; switchboards, metallic circuits, hard-drawn copper wire and "loading coils" have all been developed especially for the transcontinental service. Progress in long distance telephony is strikingly shown by the accompanying table.

Progress in Telephone Transmission

Year	Distance in Miles	Terminals
1876	2	Boston-Cambridge
1882	45	Boston-Providence
1884	235	New York-Boston
1892	900	New York-Chicago
1911	2,100	New York-Denver
1913	2,600	New York-Salt Lake City
1915 Jan. 25th	3,400	New York-San Francisco
1915 May 11th	3,800 (Via New York)	Montreal-San Francisco

Among the improvements to which the success of the transcontinental telephone service must be attributed is the use of the so-called "loading coils," the invention of Dr. Michael I. Pupin, of the Columbia University. In the form actually utilized the coils differ markedly in mechanical details from the loading coils first built. The earlier coils were as large as nail kegs, whereas the present coils are from 4 ins. to 5 ins. in diameter. They vary in size with the character of the line in which they are placed. There has been developed for use in the core of the coils, insulated iron wire 0.004 in. in diameter, of which 13,600 miles is used in the coils erected in the New York-San Francisco line.

Between New York and San Francisco there are now being operated two physical telephone circuits and one phantom circuit. The physical circuits are formed of hard-drawn copper wire of No. 8 B.W.G., 0.165 in. in diameter. The total weight of the four is 5,920,000 lbs. These wires are mounted on a total of 130,000 poles. Not over ten miles of the circuit is in underground cables. It is estimated that when a conversation is being carried on over the line equipment valued at $2,000,000 is "tied up" temporarily for this service. However, it should be remembered that three conversations can be carried on simultaneously between New York and San Francisco, while several telegraph messages can be sent at the same time over portions of the wires. When the line was extended to Denver in May, 1911, nine intermediate conversations could be carried on simultaneously over various parts of the system and twenty-eight telegraph messages could be sent simultaneously. In the Denver-San Francisco link the circuits are arranged for "phantom" operation, and similar superposition can be accomplished.

A noteworthy feature of the demonstration on May 11th, was the simultaneous utilization of numerous telephone receivers at the Montreal terminal for the benefit of persons invited to listen to the conversations carried on between Montreal and San Francisco. This result could have been achieved only by means of relays, to which beyond doubt much of the success of the long distance telephonic transmission must be attributed.

Mr. Sise has arranged for a similar demonstration of the transcontinental service to be given shortly at Toronto.

What Fools we Mortals be!

Des Moines Register and Leader

Cheap Fares Illegal?

Following the announcement of the B. C. E. R. Company that they will issue 8 for a quarter tickets, not good for transfer, the jitney association of British Columbia has raised the question of the legality of this proceeding, and one of the aldermen has moved the following resolution in council.

"That the solicitor be instructed to notify the B. C. Electric that in issuing tickets without transfers, they are violating the terms and conditions of the agreement between the B. C. Electric Railway and the city, and demanding that this violation be discontinued forthwith and that in the event of the B. C. Electric refusing to comply with the request that the city solicitor advise the council at its next meeting as to the proper legal procedure to pursue in order to enforce the provisions of the said agreement."

It is difficult to see how the action of the company in any way interferes with their agreement with the city. The company do not refuse to issue transfers on their regular tickets. It is inconceivable that the B. C. E. R. franchise is so worded as to prevent the company from giving cheaper tickets than those mentioned in the agreement, if they are so disposed. A reprisal of the form suggested by this alderman smacks of the type of warfare carried on by a nation which it is not necessary to mention.

Many Electrical Men

The death roll, cabled from the front, contains further names of men who were formerly identified with Montreal electrical interests. Lieut. Owen Carsley F. Hague, M.Sc., who died from wounds, was 26 years of age; he was a graduate of McGill University, and practised as an electrical engineer. Private Alec Clarson was the son of Mr. A. S. Clarson, engineer of the Montreal Electrical Commission, who has had four sons in the fighting line; Private Alec Clarson was, prior to joining the Patricias, employed on the staff of the Commission. Sergeant W. C. Smith, of the 14th Royal Montreals, was employed for several years in the contract department of the Bell Telephone Company. Private Stephen Gowans, of 13th Battalion, 5th Royal Highlanders, was killed by poisonous gas; he was formerly in the employ of the Northern Electric Company. Sergeant Albert V. Hardwick, traffic accountant of the Marconi Company, who was reported as killed, is, according to a cable received in Montreal, a prisoner, and is safe and well.

The Modern Distributing System

Detail features of the municipal plant of the city of Winnipeg—One of Canada's biggest water-power centres.

By E. V. Caton, Chief Engineer

The main features of the generating and transmission equipment of the city of Winnipeg municipal electric system have been described in considerable detail from time to time, but comparatively little has been said of the distributing system. In the following article the main engineering features of the distribution layout are outlined and illustrated. The modern construction of this system and its successful operation under conditions which have been sufficiently severe to test its efficiency are ample justification for a description in more detail than has yet appeared.

The generating plant is being increased as rapidly as is justified by the growing demand. At the present time seven units are operating and installation work on the 8th is nearing completion. The original plans were designed for 16 units of 5,200 h.p. capacity each, but later engineering developments have shown the possibility of increasing the total capacity, and the last three units will develop 6,800 h.p. The complete installation on this basis will, therefore, total 100,800 h.p., corresponding to a flow of 24,200 c.f.s. at 80 per cent. turbine efficiency. This flow, it is claimed, can be obtained by a system of water regulation now under consideration.

It will be recalled that transmission is at 66,000 volts on a double circuit steel tower line. The towers are alternately standard braced and flexible. Pin type insulators, consisting of 4 shells, carry 19 strand, 278,600 c.m. aluminium cables. The two circuits are loaded well up to capacity.

Terminal Station

The Terminal Station is situated on the bank of the Red River in the north end of the city. It consists of a large red brick building with stone facings. The main building has three storeys. In the basement are situated the underground cables, oil and water-piping circulating pumps for the oil and water system, oil storage tanks, and a dehydrating plant for the transformer oil. On the ground floor are the 12,000 volt bus-bars and the electrically operated switches controlling the feeders to the different sub-stations, etc., and the low tension sides of the transformers. In cells opening off this floor are the step-down transformers. Along the back of these cells is a crane way into which any transformer may be moved for repairs. On the top floor are the high tension bus and switches, lightning arresters and control gallery. Part of the front section of the building is given up to offices in which the meter and transmission line departments are accommodated.

The lines enter at the top of the building and pass first through the arrester compartments and then into the high tension room. All bus work is of copper tube, mounted on standard line insulators.

The control gallery is located in the centre of the high tension floor. The present building is large enough for eventually controlling four lines, at present two only being installed. On this gallery is the control desk, and instrument rack; also a board for controlling the local service, and, to the rear of the control desk, a switchboard which controls the sub-station (located on the ground floor), which supplies the north end of the city.

Below the gallery on the floor are two boards, one of which has mounted on it the recording meter and all relays, the other having all leads from the control and instrument circuits brought through to it and, when necessary, fused.

A battery for the control circuit is located in a room opening off the high tension floor, a small motor generator set being provided for charging this battery.

A complete oil and insulation testing outfit is also provided, consisting of a 200 kv.a., 200,000 volt transformer, with voltage regulator, electrostatic volt meter, micrometer spark gap and oil testing vessels.

On the ground floor, the 12,000 volt switch gear is arranged to take care of three banks of transformers and ten feeders, also the high tension side of the synchronous condenser installation (to be described later). All the 12,000 volt bus works and switches are in concrete barriers.

Opening off this room are the transformer pockets. There are at present installed nine 2,700 kv.a., 66,000/12,000 volt, single phase, oil insulated, water cooled transformers, connected in banks of three.

Behind the transformer pockets and opening out of them

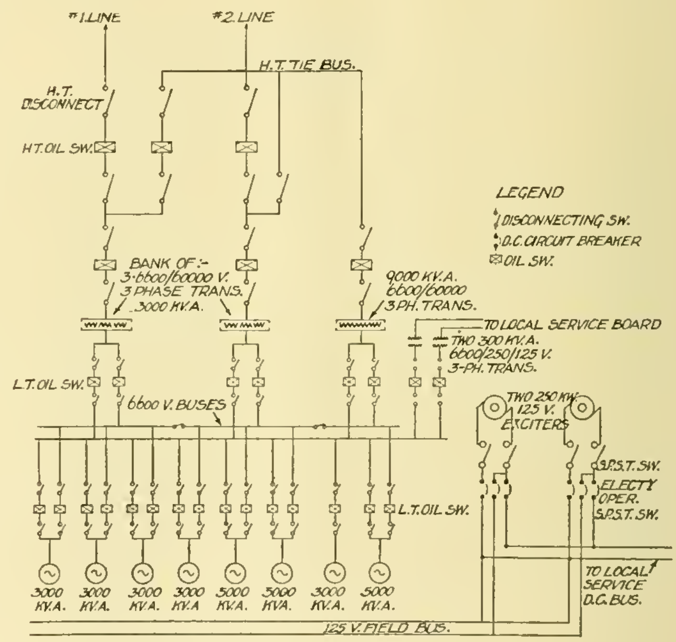


Fig. 1—Winnipeg municipal plant—Line diagram of power house connections.

by means of fireproof doors is a crane way. A railway track runs directly into and along this crane way and is connected to the C. P. R. spur. A twenty-ton electric travelling crane is provided. By suitable means any transformer can be slid out under the crane for repairs.

The water cooling system for the transformers is shown diagrammatically in Fig. 2. Water can now be obtained from two sources, either from the city mains or from the Red River. A cooling tower is situated to the rear of the main building and under normal conditions, the water is circulated through the transformers and over the cooling tower by means of pumps located in the basement. Arrangement is made to allow of the oil being drawn out of the transformer and delivered into the storage tanks in the basement; also, to pass bad oil through the dehydrator; separate pipes for good and bad oil are provided.

The general scheme of electrical connections is shown in Fig. 3. The high tension connections are similar to those at the power house. The low tension bus is in duplicate and each bus is split into two sections connected by means

of tie switches. Five feeders and one condenser unit are connected to one section and two to the other. All transformer banks are connected in delta on both low and high tension sides, and disconnecting switches are placed in all the transformer leads to allow of quick disconnection of a faulty transformer. Four tank aluminium electrolytic lightning arresters are connected to each line, and choke coils are

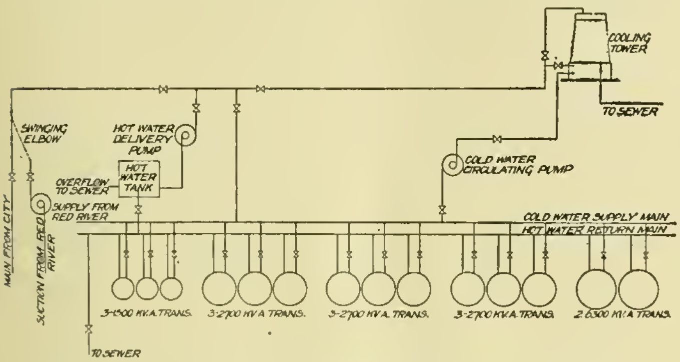


Fig. 2—City of Winnipeg Terminal Station—Piping diagram for transformer cooling water.

inserted in both line and transformer circuits. Each 12,000 volt feeder has a low equivalent excess pressure arrester connected to it.

On the ground floor are also placed three 1,500 kv.a. single phase, oil insulated, water cooled transformers, 12,000 to 2,200 volts, which supply part of the north end of the city. The switches for these transformers and their feeders are controlled from a board located behind the bench board on the control gallery, the switches themselves being on the low tension floor.

Telephone communication is provided between the different points of the Terminal Station and the control gallery.

Two Synchronous Condensers

To the rear of the main building is built an annex in which are placed two synchronous condensers, with their transformers and switches. The condensers consist of two synchronous motors of the self-starting type, rated at 6,000 kv.a.. continuous rating, and wound for 6,600 volts, 600 r.p.m. These motors are supplied by means of two 6,300 kv.a., three phase, oil insulated, water cooled transformers, which step down the 12,000 volts to 6,600 volts. The transformers and motors are placed on the same floor and on a gallery over the transformers are mounted the starting switches for the motors. Three switches are required for each motor and are connected at low voltage taps brought out from the transformer to give the required starting voltage. The control for these three switches is electrically interconnected so as to make it impossible to close any two switches in at one time.

The 1,200 volt switches for the primary of these transformers are located on the ground floor of the main building, being connected to the transformers by lead-covered, paper-insulated cables. Each of the motors has its own exciter, connected directly thereto. An electrically operated field switch and rheostat are placed on the floor immediately adjacent to the exciter. A twenty-ton hand-operated crane is provided for handling the machinery. All the switching is controlled from the main control board on the high tension floor. To assist in starting, an oil pressure pump is provided to flush the motor bearings. Automatic voltage regulators, placed on the control gallery, regulate the condensers and maintain constant voltage on the 12,000 volt bus bars.

By means of these condensers constant voltages may be maintained at the power house independent of the load and the voltage control is, within wide limits, independent of the power house. Also the capacity of the lines has been increased to approximately 80 per cent. above their previous capacity.

The motors start up with comparatively little current, tests having demonstrated that they can start up with less than 1,200 kv.a. on the high tension side of the transformers and the machines pull into synchronism perfectly.

Full kv.a., either lead or lag, can be easily obtained and the machines appear to be extremely stable, showing no signs of falling out, even with the extremely low field required for full kv.a. lag.

Distribution System

The general scheme of distribution is as follows: 12,000 volt underground cables in conduit go to the two main substations, where it is transformed to 2,300 volts. The city distribution is chiefly overhead, but in the down-town area, an underground conduit system has been installed.

There are three sub-stations for supplying the city:

No. 1, which supplies all the down-town and business district; also the south end residential districts.

No. 2, which supplies the west and northwest end.

No. 3, supplying the north end and Elmwood.

Three 12,000 volt overhead feeders are also in use, one of which supplies the neighboring town of Transcona; another, a large industrial load situated on the northwestern limits of the city; and a third, which supplies the city wells and quarries, the latter being situated at Stony Mountain, 20 miles north of the city. The general scheme of 12,000 volt distribution is shown in Fig. 4.

The underground feeders are paper-insulated, lead-

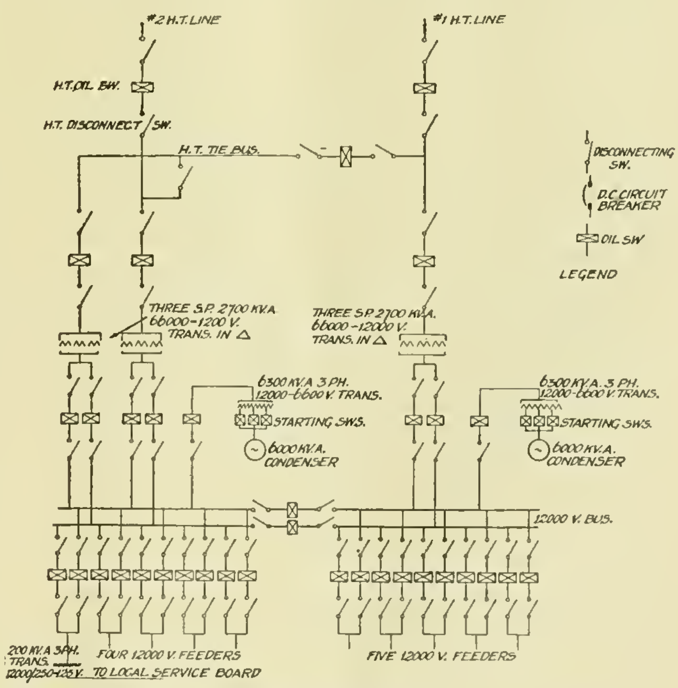


Fig 3—Winnipeg Municipal System—Diagram of connections In Terminal Station.

covered cables, having an area of 250,000 circular mils. The overhead circuits vary from No. 2 B&S to 1/0 B&S.

No. 1 Sub-station

No. 1 Sub-station, which is situated in the centre of the business district, is the largest sub-station on the system. In addition to the sub-station machinery, the building contains the business and executive offices of the Department. The sub-station equipment at present installed, consists of six 500 kv.a., 12,000/2,300 volts and three 1,000 kv.a., 12,000/-

2,300 volt, oil cooled transformers, connected in banks of three. A 250 kv.a., 3-phase, 2,200/220/125 volt transformer is provided for local service.

In addition to the transformers there are two motor-generators. Each set consists of a 750 h.p., 2,200 volt, synchronous motor connected to a 500 kw., three wire, 500-250 v. d.c. generator, running at 750 r.p.m. The machines are started up by using the exciters as starting motors, low voltage current being provided by a small 40 kw. motor-generator set. A third 500 kw. set is being installed but the motor will have self-starting characteristics.

This station, when first installed, was equipped with hand-operated remote-controlled switches, the operating board being on the main floor, but on account of the room being required for additional motor generators and switching, the old gear was completely removed and new electrically-operated remote control gear was installed. The control board for this is placed on a gallery at the north end of the building. Provision has been made for the following circuits: ten 400 amp., 3-phase, 2,200 volt circuits; six 300 amp., single phase, 2,200 volt circuits; three 250 amp., 3 phase, 12,000 volt feeders; three banks of transformers; three motor-generator sets. The board is of blue Vermont marble. The majority of the panels are 16 inches wide, equipped with 7 inch meters and a very compact board has been obtained.

The gallery is continued around the east and west walls and on the west wall are situated the feeder regulators, the east wall being partly occupied by the disconnecting and tie switches for the three incoming 12,000 volt feeders, the oil switches for which are situated on the main floor. The d.c. feeder panels are still on the main floor but it is the intention to eventually remove these to the gallery.

The 2,200 volt switching is placed in the basement. All switches are in reinforced concrete compartments and all cables leave the station underground by lead-covered, paper-insulated cables.

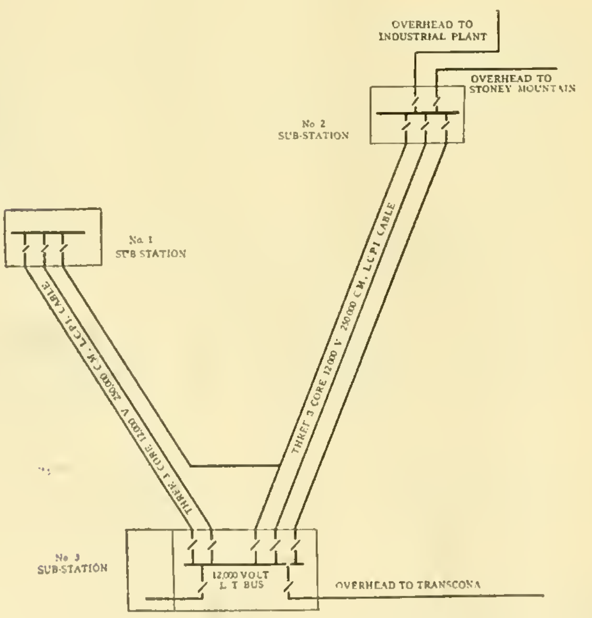


Fig. 4 City of Winnipeg distributing system—12,000 v. feeders from terminal to three sub-stations.

The building is also provided with a 20-ton electrically-operated travelling crane.

The scheme of connections in this Station is shown in Fig. 5. It will be seen that each of the three incoming 12,000 volt feeders may feed directly to one bank of transformers or that either transformers or feeders may be banked together. The 2,200 volt switching consists of a duplicate bus, all circuits being provided with two switches. Over-load relays are provided on each of the 2,200 volt feeders, the 12,000 volt feeders and transformers being protected with reversed power relays. A storage battery is provided as a stand-by for the switch control, and the control may also be taken from one of the exciters or alternatively from the small motor-generator sets used for starting.

All transformer banks are connected in delta on both high and low tension sides, disconnecting switches being installed in all transformer leads to allow of quick disconnection of a faulty transformer.

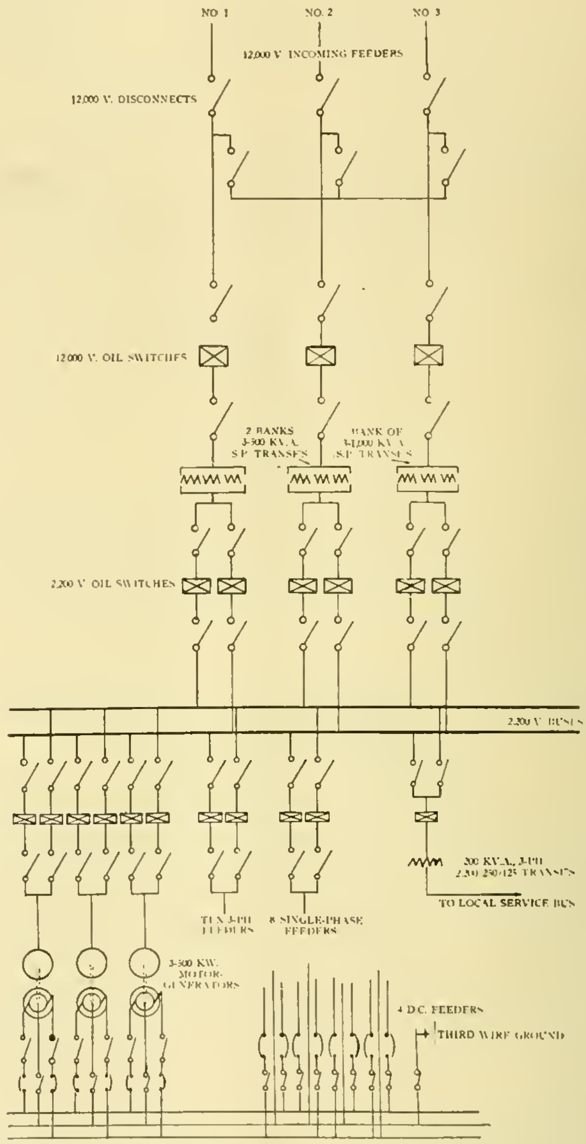


Fig. 5—City of Winnipeg—Diagram of connections for King St. sub-station.

No. 2 Sub-station

This Station, in addition to supplying the light and power load, supplies part of the street lighting of the city. The present equipment consists of nine 500 kv.a., single phase, oil cooled transformers, connected in banks of three. These transformers are located on the main floor. On the main floor are also the 12,000 volt switches for controlling the incoming feeders. The 2,200 volt switching is of the hand-operated, remote-controlled type, and is located on the main floor in front of the transformers and back of the operating board, in concrete compartments. In the basement is a storage battery for the control and a small motor-generator for charging the same. In addition to the 2,200 volt feeders leaving this station, there are two 12,000 volt overhead feeders, one supplying a large industrial plant

situated in the northwest city limits, and the other supplying the city pumping stations and Stony Mountain, a small town twenty miles north of Winnipeg. These lines are tapped directly off the 12,000 volt bus and are controlled by electrically operated oil circuit breakers located in the basement. Each of these feeders is also protected by an aluminium electrolytic arrester and choke coils. The 2,200 volt bus is in duplicate, all feeders and transformers being provided with two oil switches to allow of them being connected to either bus.

All transformers are connected in delta on both the high and low tension sides, disconnecting switches being provided on all transformer leads to allow of a faulty transformer being quickly isolated.

One end of this building is given up to street lighting equipment, which consists of thirty 7.5 amp., 50 light, constant current transformers. Also a transfer switchboard, by means of which any circuit can be plugged on to any regulator.

No. 3 Sub-station

This is located in the terminal station on the ground floor and has already been described.

Other Sub-stations

There are various other small sub-stations on the system. One is at Tyndall, 25 miles from the city, and located on the transmission line. This sub-station supplies various industrial plants located nearby. The main 66,000 volt line is tapped into this station and supplies a bank of three 300 kv.a., 66,000/12,000 volt transformers, connected in delta on both high and low tension sides. Provision is made for taking current from either line.

Two 12,000 volt overhead feeders leave this station. Aluminium lightning arresters are provided on the high tension side of the transformers.

Another sub-station is situated at Transcona, six miles from Winnipeg and supplied by a 12,000 volt overhead line, which is built on wood poles along the main line right-of-way. This station contains three 500 kv.a., 12,000/2,200 volt, single phase, oil cooled transformers, connected in delta on both high and low tension sides. Aluminium lightning arresters are provided on both sides of this line.

The following table may be of interest in showing the rapid manner in which the load on this plant has increased; load first taken on October 15, 1911:—

Date.	Meters in Service.	Max'm kw.	kw. hours generated.
December 31, 1912....	18.982	10.500	29,076,250
December 31, 1913....	27.328	14.600	54,263,300
December 31, 1914....	32.500	17.100	68,762,647

The Fixation of Atmospheric Nitrogen (Con.)

Comparative figures of production costs—An Ideal load for Existing plants with poor load factor.

The preparation of the N and H and the compression to 200 atmospheres will represent the greatest costs of production. It will be noted that all products are handled in the gaseous condition, being most favorable for low labor costs. The ammonia is extracted from the mixture of N and H by slightly cooling the gases until the point of liquefaction of ammonia is reached and the ammonia condenses out. The remaining gases are passed back to the retort without sacrificing the original pressure of compression. The work done on the gases is thus reduced to a minimum and equilibrium can be continually disturbed by withdrawing the products without heavy losses. This process involves the expenditure of approximately 1.5 kw.hr. per kg. of N and therefore represents the lowest consumption of energy of any of the fixation processes.

From an engineering point of view the various processes must be considered from other than the technical standpoint, the question of particular application being the guiding consideration in most cases.

The Economics of Nitrogen Fixation

Fertilizers.—In considering nitrogen fixation and its relation to fertilizers we must remember it is only one of the three important ingredients of fertilizers, the other two being phosphorus and potassium It is possible to obtain nitrogen from the atmosphere and transfer it to the soil by means of nitrifying bacteria which may be cultivated by such plant life as the legumes, to which family belong the clover and alfalfa. These plants have a nodule on the steam which is the seat of the bacteria activity and if the plants containing this nitrogen are returned to the soil the soil may be enriched in nitrogen, but the crop must be sacrificed or partially so. When it is not desirable to plant these nitrifying crops recourse must be had to nitrogen in the form of fertilizer. Unfortunately all crops deprive the soil of fertility, and in the case of phosphorus and potassium converted into the crops, these must actually be replaced, or barren soil will eventually result. Each soil must be treated for the particular crop it is to bear and usually there are fixed mixtures which become standard for various crops. These mixtures contain the nitrogen, the phosphorus and the potassium in varying amounts. The output of nitrogen from a chemical works would ordinarily be shipped to these further manufacturers unless the chemical works desired to manufacture the mixed fertilizers.

Of all the processes we have considered the cyanamide is the only one which manufactures a product which is in a form to go into the fertilizer market direct. The nitric acid processes must unite the acid with some alkaline base such as sodium, lime or ammonia and the ammonia processes must unite the product with an acid such as sulphuric or nitric. The nitride processes can hardly afford to ship the nitride, as it is combined with an ore or base such as aluminum oxide which may be more desirable in the aluminum industry, as the fertilizer industry will pay only on a nitrogen basis.

Prices of Nitrogen.—In general the price of combined nitrogen as we have seen, is fixed by the price of Chile nitrate. Thus if this sells for two cents per lb. and contains 15 per cent. N the price per lb. of N is 13.2 cents and this in turn would make the price of ammonia sulphate having 21 per cent. of nitrogen 2.7 cents per lb. These have been current prices. In considering the production of nitrogen products, it would seem that while these prices control nitrogen for the fertilizer industry, it would be desirable to produce if possible products which are manufactured from these crude products, and thus avoid competition with the natural products direct. Nitric acid of commerce is manufactured from soda nitrate by treatment with sulphuric acid, about 72 per cent. of the sodium nitrate being nitric acid. As the by-products of this operation only partially pay the costs, the manufacturing costs leave the nitric acid with a value of 50 per cent. over the value as nitrate. Hence a chemical works could afford to produce nitric acid when they could

not afford to add a manufacturing cost to produce a fertilizer from the nitric acid and then sell it in competition with the crude Chile nitrate.

A large portion of the phosphate rock of this country is treated with sulphuric acid to form the so-called super phosphates. If nitric acid is used in place of sulphuric acid the super phosphate can be produced at the same time as a fertilizer of lime nitrate, or if preferred a high concentration of phosphoric acid can be produced from lower grade phosphate rock. Industries of this kind promise more favorable results commercially than does the direct production of fertilizer. If low grade products are manufactured at close prices a very large volume of business is a necessity and works of this character and magnitude are more apt to be a result of successful development rather than an initial venture in a field beset with uncertainties as to the profits and the chances of a development of other processes reducing these if they are problematical.

Costs of Making Products.—Let us consider more in detail some of the costs. We may assume approximately that the labor and repairs in furnace room and absorbing tower will cost \$10 per ton of nitric acid and if nitric acid is selling for \$60 per ton, we have a margin for power cost, interest, general expense, etc., of \$50, and if we produce 500 kg. of acid per kilowatt year it will require two kw.yr. per metric ton or \$25 per kilowatt-year, and we must absorb all interest charges and general expense in this. If the yield can be made 550 kg. per kilowatt year and we can sell for \$60 per short ton, we will require 1.8 kw.yr. or \$28 per kw.yr. We must assume that the product does not have to be packed for shipment and that there are no selling costs involved, and we must figure on an output so that our units may be large enough to bring the investment in plant down to \$80 per ton of acid so the annual charge may be \$8 or net \$20 per kilowatt-year, and if \$5 are allowed for general expense the best we can do will be about \$15.00 per kilowatt-year.

We see it would be hopeless to attempt to put this acid into a product to compete with the fertilizer prices, for they are some 50 per cent. lower in selling price, and it will involve a cost for some raw material to mix with the acid, the cost of manufacture and a packing and shipping charge. We must then abandon any idea of making fertilizer from nitric acid prepared by the direct oxidation of atmospheric nitrogen in the electric arc until such time as we can improve the very low efficiency due to the thermodynamic limitations of the reaction. We can only hope to utilize this process in the manufacture of nitric acid coupled with some other product which will procure for it a higher price. There is for example a limited demand for the nitrate of sodium $NaNO_2$ used in the dye industry and this is manufactured by reducing nitric acid with molten lead thereby adding another manufacturing operation to the acid cost. This nitrite may be cheaply made by taking a mixture of NO and NO_2 such as we would have in parts of the system and passing it into water or sodium hydroxide, thus

$$NO_2 + NO + H_2O = 2\ HNO_3$$

or,

$$4NO + 2\ NaOH = N_2O + 2\ NaNO_2 + H_2O$$

and this process would produce a product selling for four to five cents per lb. We must remember, however, that the price of nitric acid is not a fixture and that a cheap combined nitrogen fertilizer will cut the price of sodium nitrate and hence the price of nitric acid. We are confronted then with the fact that all processes will be affected by the success of any one process that is a large enough success to affect the market conditions of combined nitrogen and upset the ruling prices in the fertilizer industry. It is useless to look only to cheap power as a solution of this problem as the real solution is in the improvement of processes.

Let us roughly compare the power requirements of the processes as we have outlined them above and we find

Direct oxidizing of atmospheric nitrogen 5 per cent. efficiency, yield at 550 kg. per kw.-year, requires per kg. of N. ..	65 kw.hr.
Cyanamide process 66 per cent. efficiency in carbide 1 per cent. loss in heating to combine with N., requires per kg. of N.	16.6 kw.hr.
Also preparation of N.	
Aluminum nitride using coal to heat products to temperature of reaction requires per kg. of N.	12 kw.hr.
Catalytic method of combining N and H to form ammonia, requires per kg. of N	1.5 kw.hr.
Also preparation N and H, refrigeration, and compression to 200 atmospheres.	

The general tendency abroad in figuring the cost of water power is to give only the operating costs and from this one sees costs of producing power figured at from 50 cents to \$1.00 per kilowatt year and in using these figures erroneous ideas have been widely circulated. In this country it has been standard practice to consider the investment in the power plant, that is, the cost of producing the power. It is quite common to have labor and supplies cost not more than one dollar per kilowatt-year, but this would not be considered as representing the cost of power. Where a chemical industry owns the hydro-electric power plant as well as the chemical works, the foreign practice is inclined to consider the investment as a whole or apportion the costs of operation to the various departments, while interest on the capital is charged to the profits. The costs of producing power are therefore uniformly much lower than we are accustomed to figure on. There are many plants in operation in the chemical industries abroad whose real costs of producing power are no lower than many of the more favored locations in this country.

Off-Peak Loads.—One of the chief interests in the chemical utilization of electrical energy is centered in the possibilities of off-peak or off-season loads, as American plants generally have a certain proportion of power which can be disposed of to better advantage than selling the entire output as low priced power to chemical industries. This off-peak power is difficult to utilize in furnace work, where the cooling of the furnace and its charge is an important factor both from the standpoint of cost and of output, and again, adjustments may be so disturbed from an interrupted output as to be absolutely impracticable. One of the possible solutions for off-peak utilization appears to be in the adoption of some system where fuel is also utilized and the radiation losses are not excessive under conditions of banked fire when the electric portion of the heat energy is not in use. Some of the combination processes may promise a solution of the off-peak load situation more attractive than the straight electric furnace, which is difficult to cool down entirely without unduly affecting the conditions. In all plants the volume of output is the determining factor in absorbing the general overhead charges, and any intermittance must diminish output with its accompanying disadvantages.

If the furnace could be operated on the off-season load and its product stored, and the chemical works utilizing this product could operate on a normal schedule, this would form one solution; or another would be if by chance the off-season power were available at the time the greatest demands were to be met, such as preparing a fertilizer product at the season of fall rains for the early spring delivery. All of these plans however suggest the necessity of operating at least a portion of the plant continuously in order to meet fixed charges and preserve an operating organization. If the

chemical works requires a moderate amount of power for its processes in year around operation and only its surplus for manufacturing its crude material at the off-season peak it promises the greatest possibilities.

The future of nitrogen fixation is alluring and promises, many developments along lines other than those we have considered, but already the market has felt the effect of these various processes and instead of nitrogen being figured at thirteen cents per pound, it is confidently predicted it will very shortly find its level at a selling price of about eight cents, making a cost of production of five to six cents per pound and thus reducing sodium nitrate to about 1.33 cents per pound, or approximately $30 per long ton, and the lower grade mines will feel this and be forced to curtail.

It therefore seems very certain that before 25 years shall have elapsed since Sir Wm. Crooks made his memorable address, the Chile nitrate beds will have vastly curtailed their production, not from exhaustion but from the inroads made by the onward advance of chemical and electrochemical engineering.

"Home Electrical" at the Panama-Pacific

One of the most attractive exhibits at the Panama-Pacific International Exposition, is the "Home Electrical" in the Palace of Manufactures. In this model home, electricity is made to cook, wash, launder, sweep, dust, and perform countless other domestic duties, as well as to heat, light, and cool the house.

This exhibit, conducted by the General Electric Company, is co-operative to the extent that it comprises a very comprehensive display of devices operated by this company's motors, the devices themselves being the products of other manufacturers, many of whom have no other representation at the Exposition. It is quite in contrast with the usual manufacturer's exhibit, because it is broadly educational, completely operative and required a considerable expense compared with the immediate return that might be expected through the sale of the electrical material exhibited. The idea governing the design of the exhibit was to popularize generally the use of electricity in the home.

The "Home Electrical" is in every way a practical modern home. Not a single electrical convenience is shown but would be entirely suitable for the average family and well within the means of a man of moderate income.

The building itself is of Spanish-California, bungalow design and inexpensive cost, of gray stucco, with a long columned portico on two sides, and is roofed with red tile. The interior consists of a large living room, dining room with breakfast alcove, bed room, nursery, sewing room, bath, kitchen, refrigerator room and laundry. There are also an electric garage, a workshop and a small creamery. The home in completely furnished and attractively decorated, all in good taste.

The Living Room

Beginning with the veranda the workings of electricity are everywhere in evidence. The veranda is generously illuminated with mazda lamps in suitable fixtures; the house number is an electric transparency, and electric bells operted by transformers announce your presence at any door. The living room, spacious and appropriately furnished, is lighted with mazda lamps placed in semi-indirect fixtures, the light being diffused and distributed by reflection from tinted walls and ceilings. An electric "fireplace" of the luminous radiator type furnishes both warmth and pleasing light. The electric piano player entertains visitors with either classical or popular selections.

Dining Room

Adjoining the living room is the dining room, also suitably furnished. This room is lighted by fixtures which provide direct illumination through tinted shades. It is heated by electricity and the air is kept constantly stirred and refreshed by a small electric fan. The dining room is equipped with electric heating devices for the preparation of lunches and light refreshments. There is a radiant toaster, an electric coffee pot, a tea samovar, a disc stove for general cooking, a uni-set, a chafing dish for preparing hot soups or desserts and an electric grill for broiling, toasting, preparing eggs, etc. If desired, a very substantial meal can be cooked on the dining room table. Another electrical feature is the warming closet at the entrance to the butler's pantry where the food is kept hot between courses. To the right of the dining room is the breakfast alcove, very cosily arranged and also equipped for "table cooking." This breakfast nook looks out upon a vine-covered patio, upon ferns and flowers and a little green yard wherein trickles a tiny spring.

Between the dining room and the kitchen is the butler's pantry. In it is installed a combination butler's sink and dish-washer for cleaning the light and valued wares. On a shelf there is a disc stove for making dressing and sauces, and a small electrically driven buffer for polishing nickel and silver pieces. On the wall is the annunciator of the door bell system which signals information to the maid or butler.

The Kitchen

In the kitchen, which is the workshop of every home, electricity finds its greatest field of usefulness. An electric range, equipped with hot plates, broiler and ovens, is ready to cook the largest family dinner. A constant supply of hot water is insured by an electric water heater attached to the usual kitchen water tank. The unpleasant odors of cooking are not noticed, as a household ozonator and exhaust fan combine to remove them quickly and keep the air in the kitchen pure and fresh. Should the day be chilly, a portable air heater can be put into service by inserting a small wall plug. A new device, which does away with dirty and impure ice, is the electrically lighted and cooled refrigerator, where small cubes of ice also may be obtained. There is also an electrically driven ice cream freezer, if home-made ices and creams are desired. A connection with the inter-house phone for saving steps is the final kitchen convenience.

Electric Bedroom Conveniences

The bedroom contains many electrical conveniences and articles for the toilet, including an electric massage vibrator, electric curling iron, hair dryer and boudoir lamps. There is a heating pad to take the place of the old-time hot water bag and a small electric water heater in case of sickness. The bedroom is heated by electricity in chilly weather and cooled with an electric fan when the nights are too warm. There is a connection for the vacuum cleaner. The room is also provided with a telephone connection to all parts of the house to save unnecessary steps. Most interesting of all the electrical appliances in the bedroom is the burglar switch which, when needed, lights every lamp in the house.

Near the bedroom is the nursery with its electric toys and an electrical device at the window to keep the room supplied with fresh air without dangerous drafts. The nursery is heated by electricity and there is an electric nursery out-

fit for preparing medicine, food, etc., in case of sickness. An electric heating pad is also provided to warm up cold hands and toes.

Sewing by Electricity

Every housewife visiting the "Home Electrical" takes great interest in the sewing room with its electric appliances for sewing, mending, and dressmaking. The sewing machine is operated by an electric motor controlled by the foot treadle. A three and a six-pound electric iron are located on a convenient board, and a small portable vacuum cleaner is used to pick up threads and scraps of cloth without effort. A connection to the inter-house phone saves many steps in tending to various household duties during sewing hours. A small air heater and a fan keep the room warm and comfortable at all seasons.

The Electrical Laundress

The home is equipped with a complete electrical laundry. There is a quiet-running washing machine and an electric mangle, which may be entrusted with delicate pieces; three, six, eight, and twelve-pound irons for any ironing and pressing which may need to be done, and a double 8-in. hot plate for boiling the clothes. A collapsible ironing board folds into a shallow closet, and the flatiron switch is equipped with a pilot light to indicate whether or not the current has been turned off. An air heater and exhaust fan provide comfortable working temperatures under all weather conditions.

Provision has been made, in the shed, for constant water pressure all over the house when the water supply is a well or spring. Here is installed an automatic air-pressure system connected to the water supply, keeping the pressure constant at any desired point. The air pump is driven by a small electric motor, controlled by a pressure switch.

The Electrically-Operated Workshop

Nearly every home has a workshop where the-man-of-the-house builds and repairs. This is, perhaps, more true of country places, and it must be remembered that the "Home Electrical" is by no means restricted to city folk. The shop is equipped for any ordinary repair or construction work, with a work-bench, bench-type drill press, chipping hammer, electric riveter, and grindstone. Then there is a buffing outfit, saw table, bench-type lathe, and metal melting pot, all electrically operated; handy little electric soldering irons and an electric glue-pot for repairing leaky utensils or broken woodwork. The air heater of sturdy build and generous capacity is ready at all times to insure comfort in the shop.

The Electric Garage

In the garage is a light electric coupe, which is kept charged automatically by a mercury-arc rectifier. The lighting batteries are charged by a small vibrator. A small portable search lamp, which can be operated on any electrically-lighted car, is used for close examination of any part of the car, and a portable electric tire pump complete the car equipment. Connections are made to the inter-house phone in both garage and workshop. An air heater is also installed in the garage.

Dairying by Electric Power

Of particular interest to the visitor from rural communities is the dairy. This is equipped with an electrically-driven cream separator, bottle washer and churn. In conjunction with these appliances is an automatic refrigerator and milk cooler, operated by a thermostat to keep the temperature of the cooling chamber at the proper point.

More than anything else, the "Home Electrical" emphasizes the fact that electricity is readily adaptable to all kinds of domestic service where light, heat and power are required. All these electrical conveniences are inexpensive and most of them cost no more to use than an electric iron.

Personals

Mr. Geo. Parley has resigned his position as electrical superintendent in the town of Grenfell, Sask.

Mr. Wm. O'Halloran has been appointed superintending engineer of water works and electric light in the town of Newmarket, Ont.

Mr. L. G. Ireland, manager of the Hydro-electric System, in Brantford, has also been appointed manager of the Brantford Street Railway System.

Mr. George E. Templeman has been appointed superintendent of construction and maintenance of the Montreal Electrical Commission, in succession to Mr. D. B. McIntyre, resigned.

Mr. W. E. Veidl, for some time engineer of Roper, Clarke & Company, Limited, engineers and electrical jobbers, Coristine Building, Montreal, has been appointed manager of the company.

Mr. L. F. Holmes, formerly of St. Catharines, has been appointed superintendent of the Hydro-electric System in Port Dalhousie, succeeding Mr. W. R. Savigny, who goes to Merritton.

Mr. D. L. Howard, inspector of C. P. R. telegraphs of the Medicine Hat Division, has been appointed superintendent of telegraphs of the Alberta division. Mr. Howard is a native of St. John, N.B.

Dr. Alexander Graham Bell, inventor of the telephone, was awarded the Edison medal for meritorious achievement in electrical science at the annual meeting of the American Institute of Electrical Engineers.

Mr. W. H. Somers, electrical inspector for the Hydro-electric Power Commission in Chatham, Ontario, has been given jurisdiction over the area immediately surrounding Chatham and as far west as the international boundary.

Mr. Wm. Marshall, recently appointed assistant manager of C. P. R. telegraphs in charge of lines west of Port Arthur, was, prior to his departure, the recipient of a very flattering illuminated address, given by his former associates. The address was also accompanied by a cabinet of silver and a valuable gold watch.

Mr. T. Hilliard, formerly with the Canadian General Electric Company, and more recently with the Canadian Crocker-Wheeler Company, of St. Catharines, has been appointed secretary of the Purchasing Commission just named by the Dominion Government in connection with the supply of war materials.

Mr. Stanley M. Smith who for the past few years has been representing the Canadian Westinghouse Company in the maritime provinces has opened an office in the Bank of British North America Building, St. John, N.B., and is now representing several large Canadian firms carrying a full line of electrical machinery and supplies.

Mr. J. W. Hughes has been appointed electrical engineer of the Eastern lines of the C. P. R., succeeding Mr. J. A. Shaw, who has been made electrical engineer of the entire C. P. R. system. Mr. Hughes was formerly assistant to Mr. Shaw, and has been several years with the C. P. R., prior to which he was on the staff of the Montreal Light, Heat and Power Company.

Mr. D. B. McIntyre, the superintendent of construction and maintenance of the Montreal Electrical Commission, has resigned, to accept a position in New York. Mr. McIntyre has been with the Commission for two years. He is a Canadian by birth, born in Ontario, but resided for many years in the United States where he carried out a large amount of underground conduit work. He has invented several appliances used in this class of construction.

Electric Railways

B. C. E. R. Company meet the competition of the jitney with reduced fares—Vancouver City criminally negligent of the rights of a corporation that has spent approximately fifty millions in developing the province.

On May 3 announcement was made by the British Columbia Electric Railway that on and after May 10 the company would offer a special non-transfer ticket, good only within the city limits of Vancouver and Victoria, B.C., at the rate of 8 for 25 cents. The issue of all types of tickets previously used by the company will be continued at the old rate to cover travel where transfers are demanded. These rates are straight 5 cent fare (strip of 5 tickets for 25 cents being provided for the accommodation of passengers). Workingmen's tickets at 10 for 40 cents, consisting of 5 white tickets which can only be used before 8 a.m., and 5 green tickets which are good at any time, and the usual arrangement of school children's tickets at 10 for 25 cents.

Mr. Kidd, general manager of the company, in announcing the issue of special tickets, stated that the serious decrease in the company's receipts made it necessary to choose between two alternatives. One was to reduce expenses by cutting down the service and the other was to endeavor to increase travel by lowering the fares. "It must be apparent to every citizen in Vancouver and Victoria," said Mr. Kidd, "that the service at present given cannot possibly be maintained with the present patronage. To cut down the service would have meant that a portion of our plant would be lying idle and a large number of men would have to be laid off, thereby adding to the number of unemployed in the city."

Mr. Kidd said it was "impossible for anyone to predict with anything approaching accuracy the effect of an alteration in fares. Actual experience alone could give precise information, and it would depend largely on the increased use which the public would make of the street cars to prove whether it was economically possible for the street railway company to sell eight tickets for 25 cents. If it can be done the B. C. Electric will do it.

"Many of the street railways in the United States, fortunately for them, are receiving assistance in solving their jitney problem by the strong action of the municipalities and state legislatures, in enacting special regulations to meet the dangerous conditions arising out of this new form of ill-regulated and irresponsible competition. This company has taken no part in fostering an antagonism to the jitney, believing that the common sense of the citizens and the authorities will sooner or later result in adequate regulations being enforced. The public who ride in our street cars are protected by the most stringent government regulations under the "Tramways Inspection Act," and also by the terms of franchises granted to it in mutual good faith by the various municipalities, franchises which have always been liberally interpreted by the company. To give effect to those clauses in the Tramways Inspection Act alone, clauses devised for the protection and safety of the public, over $300,000 have been spent by us on this one item during the last three years, a sum more than equal to the value of all the jitneys that are at present competing unfairly against us. To give you, for example, a few of the government regulations we are compelled to conform to—and, mind you, I am not complaining about them—the type and design of the cars we use is controlled, their brakes and motors are all periodically rigidly inspected, their carrying capacity is limited, passengers are prohibited from riding upon the steps or fenders, gates must be provided to protect passengers against their own carelessness, all cars must have proper warning signals, and the movement of cars passing each other and following each other is regulated; automatic fenders must be provided, sign boards must be visible day and night designating the exact route cars are to take, and in addition to these requirements our franchises call, among many other heavy responsibilities, for a well-timed and regulated service throughout the day over all routes, paying or non-paying, whether the traffic is light or heavy.

"Now contrast the above exacting obligations we have to meet with the conditions prevailing upon our public thoroughfares today with the jitney service in its present unregulated condition, so that our streets are becoming a menace to every citizen, no matter whether he is a pedestrian, a patron of the jitney or of the car service. All this company asks is that it shall not be subject to unfair competition; we do not fear any fair competition; we have carried the public in Vancouver almost from the foundation of the city, through the many years of its wonderful progress, a progress in which the company has played a conspicuous part, and our business is to continue in bad times as well as in flourishing times, to satisfy the public in all its reasonable demands, and by acting fairly to it, we propose to continue as the transportation company throughout our territory."

"Further, the unfair jitney competition, the absence of even the most reasonable regulation of that extraordinary traffic, has affected the credit of the company in the London money market, and until conditions improve any further expenditure on its tramway system will be altogether out of the question. In England, the investing public is hard hit by the present war, and nothing would contribute more to maintain their confidence in British Columbia enterprises than strong and speedy action by the authorities resulting in regulations being passed placing the jitneys on the same competitive footing as the street car company.

"The successful future of the B. C. Electric and the cities of Vancouver, Victoria and the surrounding municipalities is so interwoven that the authorities and the company should co-operate for their mutual advantage and the benefit of the province. The company, as I have already said, has a record to which it can point with pride as to its part in the development of British Columbia, and our desire is to still further that progress along sound economic lines.

"To come back again to the ticket question: I have intimated that the reduction of fares at the present time is an experiment—an experiment which we hope will be a success if our patrons give us their loyal support—this they have done for so many years, and if they will continue to do so,

and also use their influence to prevent our competitors having unfair advantages—then Vancouver will be able to boast, and that boast will not be an idle one, that here we have the cheapest, safest, cleanest and quickest service in North America.

"The matter now rests with the public who must be the final arbiters."

In connection with the introduction of its new special ticket, the B. C. E. R. Company decided to make it popular with the general public. As tickets were to be printed on cardboard of tango color, the name Tango Ticket was chosen and an extensive publicity programme was carried on by the company during the week May 3-10 to bring this name before the public as well as to impress upon them the benefits which would accrue to the travelling public from the standpoint of economy and the good to the city as a whole as a result of using Tango Tickets.

Half page advertisements were taken throughout the week in all daily papers in Vancouver and Victoria as well as considerable space in weekly publications circulating throughout the cities. Extensive use was also made of news articles, written from a local standpoint, as to the advantages which the public would derive from the use of the Tango ticket. One very striking illustration used in both advertisements and news articles pointed out that 32 rides at 5 cents fare meant an expenditure of $1.60, while 32 rides on Tango Tickets cost only $1, the result being the saving to the individual of 60 cents on an investment of $1.00.

The company also inaugurated a word competition, prizes being offered both in Victoria and Vancouver of $50. (First prize $20 and eight other prizes ranging down to $2) for the largest lists of words which could be formed from the letters in the words Tango Ticket.

Throughout the entire week every car in Vancouver and Victoria carried a striking fender sign noting the sale of Tango Tickets on Monday, May 10. Eight sheet posters were also displayed on billboards along the tram lines. As a result of the publicity methods adopted the words Tango Ticket became during the week the general talk of the public, both in Vancouver and Victoria.

The company also arranged to have May 10th known as Tango Ticket day in both cities where the new tickets will be accepted. The conductors of each car will wear white satin badges on which is printed in tango color, "Ask me for Tango Tickets, 8 for 25 cents." Tango pennants, 12 by 16 inches in size, on which are printed the words Tango Ticket, will also be floated from the trolley pole of each city car.

Approved track construction for city service—Crushed stone base with concrete slab covering.

A brief resume of the experience of the Virginia Railway & Power Company, of Richmond, Va., in the various methods of track construction, covering a period of the last 20 years is given in the current issue of Electric Traction. It is of special interest to note that the final decision of the company is in favor of a 7-inch rail as shown in the illustration, using white oak ties on a foundation of crushed stone with concrete paving slab above.

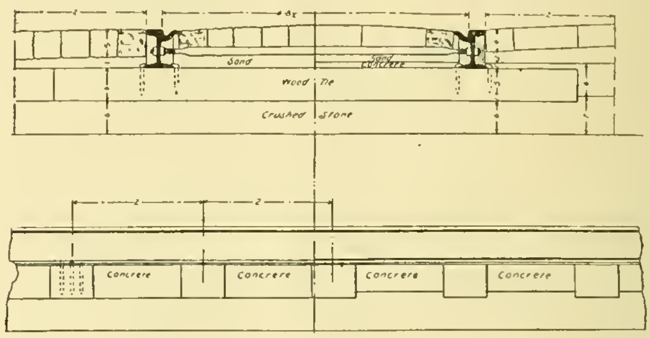
In 1896 the tracks on certain streets were built of 95-lb., 8-in. rail, laid on white oak ties, with concrete extending from 6 ins. under them to their tops. This construction later proved defective. In 1903 it was necessary to renew a number of the rail bonds, while five years later it was necessary to renew a very large proportion of the bonds. This track continued to prove costly to maintain, costing nearly three times as much as an earth supported track on a parallel street with about the same density of traffic. Moreover, it developed corrugations very badly.

Prior to 1910 the company had done little track construction or reconstruction, but in that year arrangements were made to reconstruct their main line tracks. At that time the standard construction, specified by the city engineer, called for a concrete foundation. About a mile of track was built with concrete foundation, extending 6 ins. below the rail. Carnegie steel ties (M-25) and Lorain 109-340 rail section were used.

In the summer of 1911, however, the chief engineer of the company, persuaded the city officials to authorize a change in the standard construction, permitting a foundation of crushed stone with concrete paving slab between, on top and at the ends of ties.

The track which had been laid a number of years before with concrete foundation and steel channel ties, was opened up about this time, and it was found that the concrete was in excellent condition. At 6-ft. intervals V-shaped excavations were made and new Carnegie steel ties embedded. On one street, where wooden ties had been used in concrete foundations, however, the concrete was found to be very badly broken up, the breaks occurring mainly under the rails. In two miles of track only one slab of concrete large enough to cover two ties was found that was not fractured. The breaking up of the foundation was due chiefly to trenches which had been dug under the tracks and had later settled, improper rolling, etc.

During the fiscal year of 1911-12 the company laid 11,400 ft. of 9-in. 114-lb. (Lorain 109-340 section), this section



Type of Construction Adopted in 1913 When City Agreed to Use of 7-in. Rail Instead of 9-in. Rail, and the Standard for All Track Constructed in City Limits

having the web thickened 1/16 in. Electrically welded joints were also adopted as standard, 3,630 joints being installed that year.

During the fiscal year, ending January 30, 1913, the company laid 35,000 ft., 114-lb. rail being laid throughout. About 4,000 ft. of the old concrete foundation in which Carnegie steel ties had been used, was found to be in fairly good condition when the track was torn up. About one mile of the new construction was with creosoted pine ties, tie plates and screw spikes and the rest with white oak ties and cut spikes. All of this track was laid on a crushed stone foundation with concrete paving slab. During this year 2,977 joints were electrically welded.

During the spring of 1913 the company laid 6,100 ft. of track with Lorain 114-340 section on white oak ties, with concrete slab to support the paving.

In the fall of 1913, the Administrative Board of the City of Richmond granted the company permission to use a 7-in. instead of a 9-in. rail, and also unanimously over-ruled the recommendation of the city engineer that the company be required to use a concrete foundation to all track.

During the fall of that year and the following spring 17,200 ft. of track was laid with Lorain 116-434 section, using white oak ties, crushed stone foundation and concrete paving slab. During the season of 1914 the company rehabilitated 13,000 ft. of track, using practically old rail which had been electrically welded and was in good condition. Old defective

ties were replaced with white oak ties, a concrete foundation was placed under the track and a concrete paving slab put in.

The present procedure in track construction is as follows: After excavation, the trench is rolled thoroughly with a 10-ton roller. Crushed stone is then placed in the trench to a depth of 5 ins., the track laid and loose stone thrown in so as to surface the track to the proper grade. Traffic is then turned over the track for a period varying from three to six days, depending upon its density. The track is then gone over again and resurfaced, tamped and lined up, after which the concrete paving slab (a 1:3:5 mixture) is poured.

The C. M. & St. P. Electrification—Further details of first 3000 v., d. c., Equipment

By C. A. Goodnow*

The Chicago, Milwaukee & St. Paul Railway Company is now engaged in the electrification of that portion of its main line to the Pacific coast between Harlowton, Mont., and Avery, Idaho, a distance of 440 miles. This project is of special interest because: (1), it provides for the electrification of four entire engine districts; (2), this work is being done to effect economies in operation on a single track line of moderate traffic and not to overcome congestion on a busy line now working to its capacity or to eliminate the smoke nuisance.

Between Harlowton and Avery this line crosses three mountain ranges, the Belt Mountains at an elevation of 5,768 feet, the Rocky Mountains at an elevation of 6,350 ft., and the Bitter Root Mountains at an elevation of 4,200 ft. There are several tunnels, the longest of which is the St. Paul Pass tunnel at the summit of the Bitter Root Mountains, 9,000 ft. long. The maximum grade westbound is 2 per cent. for 20.8 miles on the eastern slope of the Rocky Mountains, while the maximum grade eastbound is 1.7 per cent. for 24 miles approaching the St. Paul Pass tunnel. The hardest problem of this nature, however, is presented by the continuous 1 per cent. grade for 44 miles, ascending the western slope of the Belt Mountains, involving as it does the necessity for special precautions to avoid overheating the motors while working at their maximum capacities for this long period of time.

Besides the yards at Harlowton and Avery, intermediate terminals are now located at Three Forks, Deer Lodge and Alberton. These terminals are all small and with the exception of Butte and Missoula, there are no towns of any importance within these limits. There is, therefore, practically no breaking up of trains as all traffic is through business. Including these yards and side tracks about 650 miles of track will be electrified.

Power will be purchased from the Montana Power Company. Owing to the ample supply of water power available and the low cost of construction, the unusually low contract rate of $0.00536 per kilowatt hour has been secured. By contracting for its power the railroad thus avoids expending directly the large amount required for the construction of power plants. To minimize peak loads it is probable that the duties of the train and power despatchers will be combined. In this way the spacing of trains can be best arranged to keep the peak loads down to the minimum. With the traffic existing on this line it is expected that this can be done without serious interference with the operation of freight trains.

Tie-in Transmission System

To minimize the dangers of interruptions to the delivery of power a tie-in transmission system is being built by the railway to permit feeding each substation from two directions and from two or more sources of power. The transmission line is being constructed with wooden poles, will operate at 100,000 volts and in most cases will follow the right of way.

The Montana Power Company will deliver energy to the line at seven points between Harlowton and Avery. On the engine district between Three Forks and Deer Lodge, on which work is now under way, three substations are being built to convert the 100,000 volt, 60-cycle, 3-phase alternating current to 3,000 volts direct current. This is the first direct current installation using as high a potential as 3,000 volts and was adopted after observing the results secured with the 2,400-volt, direct current installation of the Butte, Anaconda & Pacific, which parallels the line of the St. Paul for a short distance west of Butte.

The trolley construction is of the catenary type, with two 4/0 trolley wires flexibly suspended from a steel catenary and supported on wooden poles with brackets on tangents and flat curves and cross spans on the sharper curves and in yards, the twin-conductor trolley consisting of two 4/0 wires suspended side by side from the same catenary by independent hangers alternately connected to each trolley wire. This permits the collection of very heavy current by reason of the twin contacts of the pantograph with the two trolley wires.

Contracts were let last year for 9 freight and 3 passenger locomotives for use on the first engine district, while 9 additional locomotives were ordered early this month for use on the second engine division from Three Forks to Harlowton. The passenger locomotives are designed to haul 800-ton passenger trains at a speed of 60 miles per hour on the level, or 35 miles per hour on a 1 per cent. grade, and will be equipped with oil-fired steam heating outfits for heating the train. The freight locomotives are designed to haul a 2,500-ton train on all grades up to 1 per cent. at a speed of approximately 16 miles per hour. This same train load will be carried unbroken over the 1.7 and 2 per cent. grades with the help of a second similar locomotive acting as a pusher. At the summits of the grades, provision is being made to run the pusher locomotive around the train and coupling it to the head end to assist in the electric braking on the descending slopes. In addition to providing the greatest safety in operation, this will also enable a considerable amount of energy to be returned to the trolley for the assistance of other trains and reduction in the power bill. The electric locomotives will have sufficient electric braking capacities to hold the entire train on the down grade, leaving the air brake equipment for use in emergencies or when stopping the train.

First Section to Operate in October

At the present time work is being actively pushed on the engine district between Three Forks and Avery, 113 miles, crossing the summit of the Rocky Mountains, and it is expected that this will be ready for operation next October. Work is now also being started on the engine district from Three Forks east to Harlowton and it is planned to start work on an additional district each year until all four are completed. The contract with the electrical company provides that the entire 440 miles be in electric operation by January 1, 1918.

Several important economies are expected from the electrification of this line. In the first place this is the first time an entire engine district has been electrified, permitting the complete substitution of electric for steam locomotives between the terminals. In other installations throughout the country only a portion of a division has been electrified, resulting simply in a shortening of the steam operated engine district. With the present schedules enforced with train employees this has not enabled the savings to be secured which will result from the electrical operation of the entire engine district. Furthermore, with the electrification of four

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* Assistant to the President, Chicago, Milwaukee and St. Paul R. R., before the A. I. E. E.

adjoining engine districts, it is planned to change locomotives only at the second terminal or at Deer Lodge. The crews will be changed at the intermediate terminals, Three Forks and Alberton, but there will not be the delay incident to the present methods of operation. It will be possible to abandon these intermediate terminals with the exception of a small amount of trackage on which to set out bad order cars, hot boxes, etc. It is also expected that with the low contract price for power which has been secured, a considerable saving will be made over the amount now expended for fuel. From these and other savings expected, it is anticipated that this expenditure will yield a very attractive return on the investment. If this is realized, it is possible that electrification may be extended from Avery across the Cascade Mountains to Seattle and Tacoma, a total distance from Harlowton of 850 miles, but not, however, in the near future.

Enthusiastic Meeting in Favor of Hydro-radials

As typical of similar meetings being held at various points in the province of Ontario in favor of the Hydro Radial movement, an enthusiastic meeting was held in Hamilton on May 13th, at which civic representatives and delegates from adjoining municipalities met to discuss and place themselves on record as favoring the scheme. The following resolution involving organization and the appointment of officers was unanimously adopted:—

"That this meeting representing some 15 municipalities of the counties of Wentworth and Haldimand, having in view the immense advantages to be derived in this province from the construction of radial railways under the Hydro-electric Commission, in order to uphold the hands of the said commission and place an organization at their disposal does here and now form itself into a union to be known as the Greater Hamilton Hydro-electric Radial union.

"That the members of this union shall be the muncipalities here now represented, together with any other municipalities in the district having similar needs and being in entire sympathy with the objects of this union.

"That the objects of this union shall be the dissemination of useful information amongst its members and giving assistance to the commission in gathering of necessary statistics; an organization for campaign purposes acting automatically when the engineers of the commission are in a position to place in its hands all information as to cost of construction, operation, method of financing and location of line; to educate every citizen in the municipalities covered by said union in order that when the said municipalities are asked to guarantee the debentures to build said line, the response will be a unanimous one.

"The executive committee shall be composed of the officers, twelve members and the mayor or reeve of the municipality.

"And the officers together with such members as can conveniently attend shall constitute a quorum for the transaction of such business as may be necessary during the intervals between the general meetings of the executive committee."

Regulating the Jitneys in San Francisco

An ordinance regulating the operation of jitney buses has just been passed by the Board of Supervisors of San Francisco. It will be noted that the regulations do not compensate the city for any loss in revenue due to the reduction in street car receipts which, in the case of many Canadian cities, is very considerable.

Before operating a jitney bus the owner must obtain a permit from the Police Commission, and the driver must obtain an operator's permit.

The application for a permit must set forth the type and make of the vehicle, its horse-power, factory number, state license number, seating capacity; name of owner or lessee; name of driver and the number of his state license. The driver must have had at least 30 days' experience in running an automobile in San Francisco; must be physically qualified to drive a motor car safely, with sight and hearing unimpaired; and must pass an oral examination to show his knowledge of the traffic laws and rules of the city.

The applicant must file a bond or an insurance policy in the sum of $10,000 to pay all loss or damage that may result to any person or property from the negligent operation of or defective construction of said jitney bus, or which may arise or result from any violation of any of the provisions of this ordinance or the laws of the state of California. The recovery upon said bond shall be limited to $5,000 for the injury or death of one person and to the extent of $10,000 for the death or injury of two or more persons in the same accident and to the extent of $1,000 for the injury to or destruction of property.

License fees are to be paid in advance, varying with the seating capacity as follows: Seating capacity five or less, $10 per year; six or seven, $15; eight to fifteen, $25; more than fifteen, $40. The driver must hold a state chauffeur's license and must wear a badge issued by the Police Commission at a cost of $1.

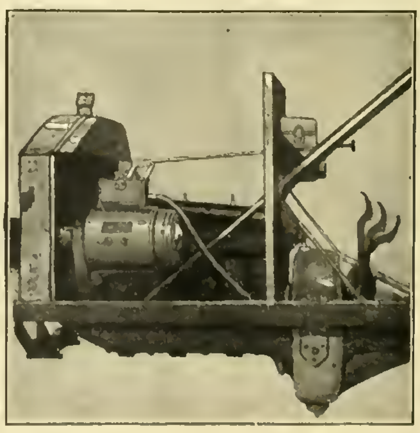
Passengers are not allowed to ride on the running boards or fenders. Buses must be provided with horns or bells, which must be sounded before crossing any intersecting street. Buses must be swept and cleaned daily, thoroughly washed weekly, and disinfected whenever directed by the Board of Health.

Drivers are forbidden to smoke while there are passengers in their cars. A driver who operates his car while under the influence of liquor, or in a careless or dangerous manner, forfeits his right to the badge already mentioned and is disqualified from driving a jitney bus.

Before taking a descending grade of 5 per cent. or over, the driver must reduce speed so as to test his brakes, which must also be inspected and tested daily. Non-skid devices are required when operating on slippery pavements. Buses must come to a full stop before crossing a steam railroad track. In loading or unloading passengers, the side of the vehicle must be within 2 ft. of the right-hand curb.

In case of fire, accident, parades, obstruction, breaks or repairs in streets, or to prevent congestion of traffic, or under other necessity, the police may divert jitney buses from their regular routes to other streets.

The violation of any of the provisions of the ordinance is punishable by revocation of permit, a fine not to exceed $100, or imprisonment for a period of not more than three months, or by both such fine and imprisonment.



The genemotor—An electric starter made specially by the C. G. E. Co. for Ford motor cars.

The Dealer and Contractor

Safeguarding the Eyesight of School Children—An Insistent Demand for Both Humane and Economic Reasons

By M. Luckiesh*

According to the available statistics about 10 per cent. of the number of school children examined are found to have defective vision. In many cases the percentage of defectives has been found to increase with increasing age. This increase can be attributed largely to the manner in which the eyes are used. Light being essential to vision, it is natural to turn to lighting for a possible cause of the increase in the number of children with defective vision. Considering those that are already defective it is certain that proper lighting and proper use of the eyes will result in a large number being permanently cured. Further, this is an age of prevention as well as cure. Prevention of defective eyesight means proper lighting and proper use of the eyes. It should be remembered that the child's eyes are immature in growth and function and therefore quite susceptible to misuse. Insufficient illumination whether due to shadows owing to improper direction of light or to an actual deficiency in the amount of light at a particular desk results in the tendency of the child to hold the reading matter too close to his eyes. Practising this continually, results in a malformation of the eye muscles and consequent near-sightedness. The tendency once begun requires more effort to correct than to prevent beforehand.

Glare from windows, blackboards, glazed paper or artificial light sources causes eye-fatigue with resulting disorders too complicated to discuss in a paper of this nature. A lack of training in avoiding such conditions also aids in increasing the number of children having defective vision.

Prof. Johan Widmark of Sweden in a paper on "The Decrease of Short-sightedness in Secondary Schools for Boys in Sweden," presented at the Fourth International Congress on School Hygiene held in Buffalo in 1913, publishes some interesting statistics referring to three kinds of schools, "classical," "mixed" and "modern." These illustrate the increase in near-sightedness with increasing grade of class. The classes are named first, second, third, fourth, fifth, lower sixth, upper sixth, lower seventh, and upper seventh. The corresponding percentage of near-sighted pupils is shown for each class. The most striking feature is the unquestionable increase of near-sightedness from class to class, a further point of interest being the greater prevalence of near-sightedness in the "classical" school than in the "modern" school. Another school which has both the classical and modern side has in general a slightly less percentage of near-sighted pupils than found in the classical school.

These statistics also show the steady decrease in the percentage of short-sightedness in the highest classes of all the state secondary schools for boys in Sweden from 1895 to 1906. Data obtained in 1883 but perhaps not directly comparable with the foregoing data showed a percentage of near-sightedness as high as 65 per cent. in some schools. Prof. Widmark accounts for the decrease in short-sightedness in recent years as follows:

Among the hygienic improvements which have been effected during recent years in our schools and in all the conditions relating thereto I should be disposed to mention first the improvements in the lighting of rooms and in the printing of the books used by pupils, and that for this reason among others, the influence of these changes is of effect in the homes too, the strain on the eyes when the pupils are busy with the preparation of lessons being thereby much reduced. If the comparison is made between the methods of lighting rooms now and those of ten years ago, the difference is very striking, both at school and at home.

He further comments upon the significance of the decreased use of the old Gothic types.

Opinions of Other Authorities

At the Buffalo meeting on School Hygiene, conservation of vision received marked attention as is illustrated by the following abstracts:

D. P. MacMillan, director of child study in the public schools of Chicago, states: "Defects of the senses of sight and hearing, to which appeal is largely made in school room activities, are considered by some to be the primary causes of delay or derangement of normal development, and they lead to the formation of injurious habits, etc."

W. H. Brainerd, an architect of Boston, states in discussing "The Ideal School Site": "The first purpose of the school is instruction. The first need of instruction rooms is light for the use of the eyes and apparatus. Light must be in abundance and without glare. Sunlight should reach all instruction rooms, and others as far as possible. Long continued hot sunlight is not desirable in class-rooms. The desirability of exposure for class-rooms is in the following order: easterly, southerly, westerly. For large buildings a site permitting of the major axis running northeast and southwest is most desirable. Class-rooms should have the easterly and southerly exposures; assembly halls and accessories westerly and northerly exposures."

Dr. F. Park Lewis of Buffalo in a paper on "Sight Saving and Brain Saving," states: "It is an accepted fact, recognized by ophthalmologists everywhere, that changes occur in the eyes of children during the period of their school life, of which the most prominent symptom is a steadily progressive development of near-sightedness. As definitely formulated by the late Prof. Dufour: (1) In all schools the number of short-sighted pupils increases from class to class. (2) The average degree of short-sightedness increases from class to class. (3) The number of short-sighted pupils increases with the increase in school demands."

Dr. James Kerr of London, states: "Ocular experience is the only final test of illumination. Eyestrain is due to fatigue due to overwork or glare. The eye adapts itself to brightness by varying its sensitiveness. Primary glare is due to physical effects on the retina, secondary glare to difficulty in adaptation. One third of our school children have

* Before the Illuminating Engineering Society.

such defective visual acuity that better illumination is necessary than for normal eyes. Artificial lighting for each school place should not be less than 2 foot-candles. Blackboards require 60 per cent. more. Glare must be guarded against."

Dr. Lewis C. Wessels of the Bureau of Health, Philadelphia, in speaking of defective vision from the economic standpoint states: "In Philadelphia each pupil costs about $35 per year to teach. Under normal conditions a pupil 14 years of age should reach the eighth grade at a cost to the state of $280. If on account of defective vision the child only reaches the fourth grade in that time it has still cost the state $280, but with only $140 worth of result, a loss to the state of $140. The loss to the child is considerably more because at the age of 14 it is likely to be put to work, poorly equipped, its earning power curtailed for want of a proper education so that it can contribute but little toward its own support or that of the state. So again the state loses." He further explains how the Department of Public Health through a division of ophthalmology furnishes glasses free to poor children and adds: "We are now refracting nearly 2,500 cases a year. If we save each one of these children but one year during its entire school life there will be an annual saving of over $87,000 not counting the child's time and increased efficiency."

This is certainly an interesting phase of the subject. A further discussion of the economics of the relative costs of prevention and cure would also be of interest.

These are opinions and statistics from only a few authorities but probably sufficient to rout any lurking suspicion that the safeguarding of eyesight is not a vital problem. Further it is seen that the light expert has a great deal in common with school authorities, medical examiners, and architects in safeguarding the most important and educative sense—vision.

Factors Influencing Vision

Illumination.—The eye is a very flexible organ and can adapt itself to a tremendous range of brightness. Visual acuity or the ability to distinguish fine detail depends upon the illumination, although above a certain minimum, value of illumination acuity increases very slowly with increasing illumination. One sees by distinguishing differences in brightness and color. In ordinary reading brightness contrast makes it possible to distinguish the black letters or words on the lighter background. After a certain minimum value of illumination is reached the process of distinguishing ordinary type becomes increasingly difficult with decreasing illumination. The amount of illumination necessary for reading with comfort depends upon a number of conditions, but under fairly satisfactory conditions the illumination at the top of any desk should not be less than 2.5 foot-candles. This minimum value should be greater for daylight than for artificial lighting because of the greater non-uniformity of the illumination under average natural lighting conditions indoors.

Uniformity.—A fair degree of uniformity of illumination on the plane of the desk tops is quite desirable owing to the strain on the eyes resulting from the necessity of adapting the eyes for considerable variations in brightness where there is too great non-uniformity. Owing to architectural difficulties it is quite impossible to obtain uniform illumination with natural light. The diversity, however, can be reduced even in this case to a satisfactory value. Satisfactory uniformity is easily attainable in artificial lighting.

Direction of Light.—One of the fundamental principles of proper lighting is to have light come from the left. This of course assumes that all persons are right-handed. In natural lighting three systems are in vogue, unilateral, bilateral and sky-lighting. The predominant opinion favors unilateral lighting with the windows on the left of the pupils when seated.

In artificial lighting there are three general systems of lighting, the so-called direct, semi-indirect, and indirect lighting. These divisions are not clearly defined. The first system in which most of the light is directed downward by shades and reflectors is perhaps used more than the others although the semi-indirect method is growing in popularity in many places and is perhaps more generally satisfactory in the problems of lighting class-rooms, reading rooms, etc. In this system the light source is contained in a translucent glass bowl open at the top. Some light passes through the bowl to the working plane, the remainder reaching the working plane indirectly by reflection, chiefly from the ceiling.

Glare.—In natural lighting the sky is the source of light chiefly depended upon. Very elaborate studies of the amount of visible sky necessary at any point of the room have been made by reflection chiefly from the ceiling. Various authorities agree in general, notwithstanding the fact that the data have been gathered by different methods. The brightness of the light source whether natural or artificial, should be low, say not more than three candle-power per square inch. The brightest sky measured by the writer has shown 2.5 candle-power per square inch. One of the important effects of high brightness is the production of annoying after-images. The brightness of a tungsten filament operating at 7.9 lumens per watt (1.25 w.p.m.h.c.) was found to be 1,080 candle-power per square inch. In the same units the approximate brightnesses of a Welsbach mantle and a frosted tungsten lamp of the older type are respectively 30 and 5. These figures are given to aid in comprehending the data. The after-images from bare artificial light sources besides fatiguing and being harmful to the eye can be annoying owing to loss of time occasioned and dangerous when the person is working near machinery owing to the temporary blinding effect. Nevertheless inspection shows that bare lamps directly in the field of view are often found in the shops in technical schools where there is an ever-present danger from machinery in operation.

Intrinsic brightness is not alone the cause of glare. An area of sky when viewed through a window surrounded by relatively dark walls causes a very annoying glare yet the sky is perhaps no brighter than 1 candle-power per square inch. Thus excessive brightness contrasts are found to be responsible for the annoying, and sometimes very discomforting and harmful conditions of glare. This is shown by an easy experiment. Hold a lighted electric incandescent lamp before your eyes in an ordinary room and under most conditions you will experience uncomfortable glare. However, if you take the lighted lamp to the window and view it against the sky the glare is hardly noticeable. There is another factor that complicates the situation, namely, total light flux. More light is entering the eye in the latter case which possibly, by the process of adaptation, reduces the annoyance somewhat. It has become recognized, however, that brightness contrast plays a large part in eye-fatigue. A blackboard viewed in juxtaposition to a white wall often results in annoying glare.

Light surroundings such as walls and ceiling have a general tendency in reducing the conditions of glare. For instance a bright ceiling reduces the annoyance of an artificial light source viewed against it. Light walls reflect light back to the side of the room containing windows thus lessening the contrast between the bright sky and the adjacent walls. The colors of walls and ceilings usually found satisfactory are light tints of buff, yellow, or grey.

Artificial light sources should be hung high in order to be outside the normal visual field if possible. They should be screened with shades or reduced in brightness by enclosing glassware. Likewise windows should be equipped with approved shades in order to control the daylight as much as possible and, when necessary, to screen out the direct sunlight.

Polished surfaces are recognized as sources of annoying glare and in many cases defeat well laid plans of the

lighting specialist. Obviously a child holding a mirror flat upon the printed page of a book can see the image of a light source which is well above his head out of the normal visual field. The result of glazed paper too often used in books is somewhat analogous. Owing to the fact that the image of the light source is regularly reflected by the black letters and white background with practically equal facility, there is a decrease in contrast between the printed matter and the background causing difficulty in reading and also a distracting and harmful effect of the "glare spot." For these reasons glazed surfaces have been condemned by the light specialist. Glare owing to regular reflection from blackboards is a common annoyance in school rooms. This can be overcome in various ways including tilting, the judicious use of window shades, and by lighting them artificially.

Legislation on School Lighting

The legislation on this subject which has come under the observation of the author has been chiefly with reference to natural lighting. This is quite the expected course, but needless to say attention must be given to artificial lighting. The latter problem will be found much easier and no doubt will be officially taken care of eventually. It is the duty of this society and school authorities to urge proper legislation to cover lighting conditions completely. It may be interesting to quote extracts from codes already in existence. Extracts from the Indiana "Sanitary School House Law" are as follows:

Interior walls and the ceiling should be painted or tinted some neutral color, as grey, slate, buff or green.

All school rooms where pupils are seated for study shall be lighted from one side only, and the glass area shall be not less than one-sixth of the floor area, and the windows shall extend from not less than 4 feet from the floor to at least 1 foot from the ceiling, all windows to be provided with roller or adjustable shades of neutral color, as blue, gray, slate, buff, or green.

For left-handed pupils desks and seats may be placed so as to permit the light to fall over the right shoulder.

Blackboards shall be preferably of slate, but of whatever material, the color shall be dead black.

Extracts from the Rules and Regulations of the Indiana State Board of Health are as follows:

No class-room shall exceed 24 feet in width, with the ceiling not less than 12 feet nor more than 14 feet in height.

No window sash shall have more than four lights, and the tops of all windows shall be square. When the proximity of other buildings or a portion of the same building interferes with the proper lighting of a class-room, the light shall be properly projected and diffused by the use of prism glass.

When artificial lighting by means of electricity or gas is used the lights shall be placed near the ceiling and the lights deflected by proper shades toward the ceiling, either indirect or semi-indirect lighting being used.

Where the light in any class-room is from the north, the proportion of glass area to floor area should not be less than 1 to 5.

Architects, etc., shall certify by affidavit indorsed on all plans and specifications submitted that such plans and specifications comply with the Indiana Sanitary Schoolhouse Law and with the rules of the Indiana State Board of Health.

Abstracts from the Ohio State Building Code referring to school buildings are as follows:

The height of all rooms, except toilet, play, and recreation rooms, shall be not less than one half of the average width of the room, and in no case less than 10 feet high.

The proportion of glass surface in each class, study, recitation high school room, and laboratory shall be not less than 1 square foot of glass to each 5 square feet of floor area.

Windows shall be placed at the rear or the left and rear of the pupils when seated.

Tops of windows, except in libraries, museums, and art galleries, shall not be placed more than 8 inches below the minimum ceiling height.

The unit of measurement for the width of properly lighted rooms, when lighted from one side only, shall be the height of the window head above the floor.

The width of all class and recitation rooms, when lighted from one side only, shall never exceed two and one half times this unit, measured at right angles to the source of light.

The candle-power of electric lamps shall not be less than the following, viz.:

Auditorium	1 candle-power to 2½ sq. ft. of floor area
Gymnasium	1 candle-power to 2½ sq. ft. of floor area
Stairways and hall	1 candle-power to 4 sq. ft. of floor area
Class and recitation rooms ..	1 candle-power to 2 sq. ft. of floor area

Enclosed fireproof stairways, service stairways, corridors, passageways, and toilet rooms shall be lighted by artificial light and said lights shall be kept burning when the building is occupied after dark.

The Illuminating Engineering Society is taking up the matter of the lighting of schools chiefly through a recently appointed Committee on School Lighting. Observations have been made and data have been collected for several years previous to the appointment so that fairly definite activities were begun at once. The following brief resume of requirements in school lighting was presented to the Committee on Lighting Legislation for use as a basis in formulating a code on school lighting. This is not in complete form, but is expected to serve as a starting-point.

General Consideration

The lighting of a school building should be referred to a competent expert before the plans for the building are drawn. The importance of doing this early is evidenced by the fact that the orientation of the building plays an important part in the design of those features which depend for their satisfactoriness upon proper lighting.

Minimum intensity of illumination, 2.5 to 3.0 foot-candles on the plane of the desk top.

Polished surfaces such as blackboards, glossy paper, polished desk tops, and glazed walls should be avoided.

Light sources (sky or artificial) should be well out of the ordinary visual field.

Glare from blackboards should be avoided. This can be done by carefully placing them, by lighting artificially, by tilting them, and by keeping their surfaces mat. They should never be placed between windows.

Excessive brightness contrasts should be avoided. A bright source should not be viewed against a dark background. The walls adjacent to a blackboard should not be too light in color.

Surroundings such as walls and ceilings should in general be light in color. Ceilings and frieze should be practically white (high reflecting power). Walls should be reasonably light. Colors used should be white, grey, or tints of buff, cream or olive green.

Children should be taught how to safeguard their vision; that is, how to hold their books, to assume a correct position relative to the light source, to complain of glare from blackboards, etc.

Teachers should be instructed to teach these fundamentals to the children.

Good lighting should be incorporated in every course

where practicable and especially in the "home-making" course.

More Specific Recommendations

Natural Lighting.—Window area should be ample—that is, an appreciable percentage (say at least 20 per cent.) of the floor area.

The windows should preferably be located on one side of the room to the left of the students.

A portion of the sky should be visible from every desk top, at least 5 degrees vertically.

The width of the room should not be more than twice the window height.

The windows should be equipped with approved window shades for controlling the light and excluding direct sunlight.

Prism glass should be used in extreme conditions at least.

Lighting and ventilating courts should be painted white.

Minimum illumination on desk top, 3 foot-candles.

Diversity of illumination not greater than 100 to 1.

Artificial Lighting.—Ample general lighting is recommended. Local units subject to control of pupils are condemned.

Minimum illumination on desk top, 2.5 foot-candles.

Light sources should be out of normal visual field if possible. They should be equipped with diffusing glassware to reduce their brightness and screen the source from the pupils' eyes.

Highest permissible brightness, 3 candle-power per square inch when viewed against a light background.

Blackboards should be lighted by properly screened and judiciously placed local units.

The system of lighting will depend upon many conditions. Any well-designed system is satisfactory in its proper place. There appears to be a growing tendency for the semi-indirect system. It appears more generally satisfactory for class rooms, reading rooms, etc. In the shops a direct system is advisable.

No local units should be used unless absolutely necessary.

Electric Co-operation—in Fact—and Fancy

Someone has said that the word "co-operation" is being worked to death.

Co-operation—the actual fact—sounds as good, is as good, as it ever was, but the "word" and the "fact" are two different things. People are "talking" co-operation and forgetting to "act" it. If we don't watch out, the very name will become a joke and the fact for which the word ought to stand will become a joke with it.

I do not know if I make myself plain, but here is an illustration: In a large Canadian city, the retailers in a certain line are agitating—and working hard—for an association. They argue, wisely, that co-operation would be a fine thing. Yet in that same city, we have among these very men a striking example of what this term means to them—three well-equipped, competitive stores located side by side, with only the thin, nine-inch walls between. And this in itself is not so bad, but, as the result of this unusual condition, each dealer feels such keen resentment at the presence of the others, that he misses no opportunity to refer to them in uncomplimentary terms to any customer who may lend a willing ear. Yet these men "talk" and apparently believe in co-operation.

To come nearer home—in the city of Toronto there is an Electrical Contractors' Association of some years' standing. The hand of this association has been seen in many of the changes that have taken place for the betterment and uplift of the electrical contracting business. Its influence has been widely and frequently exerted, and is fully recognized and respected as having at heart the welfare and improved working conditions of all local electrical contractors. Yet, within the last few weeks we hear of a second similar organization, comprising certain of those who, for one reason or another, are not members of the original association. Thus we have two asssociations, with the same aims, the same common interests and, if you like, the same enemies, duplicating a machinery that could just as well do the work of both.

We have no reason to doubt the sincerity of either of these organizations, but—why misuse the word "co-operation?" If these two associations were composed of men who really appreciated the meaning and the value of this term, there would be only one association—stronger, more vigorous and more useful than either of the two existing associations can ever possibly become alone. At best, it is the condition of a divided house—and what happens to a house divided against itself was long ago placed on record.

The trouble with most of us is that we get the two words "selfishness" and "co-operation" mixed up. Our definition of co-operation is "The other fellow working with me for my interests."

That is all wrong.

The real definition is—"Working **with** the other fellow for **our** interests."

If **you** do that and **I** do it and the **other fellow** does it, keeping "I" always in the background and "our" always prominently in mind—that is real team-work.

How would it affect the outcome of the European War if France, England and Russia disregarded their common enemies and started shelling one another?

The enemies of electrical contractors are as clearly defined as are our enemies in Europe—rising costs of doing business, heavy overhead charges, incompetent workmen, wage problems, variable selling methods of manufacturers and jobbers, apathy of the consuming public, and so on. These are tremendously real and formidable enemies.

Yet our forces are unorganized and, to a certain extent at least, we are warring among ourselves.

What are the chances that we can overcome our common enemies unless we—**all**—pull together?

Change of Address

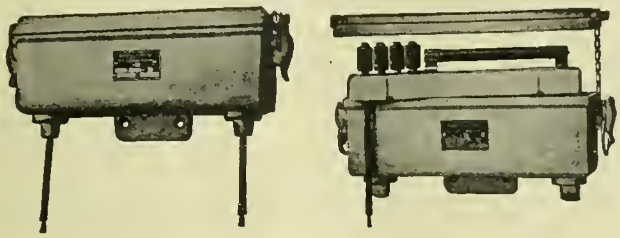
Owing to the rapid expansion of their business the Chamberlain & Hookham Meter Company, Limited, find it necessary to considerably enlarge the facilities for handling their goods. With this object in view they have taken more commodious premises in the Temple Patterson Building, 243 College Street, Toronto. Equipment of the most modern character for building and testing meters has been acquired, including several high grade precision instruments. This up-to-date plant will be the means of enhancing the present good name of the C. & H. meter for accuracy and dependability.

The gross earnings of the Montreal Light, Heat & Power Company for the year ending April 30th, 1915, show an increase of $371,408, or approximately 6 per cent. over the previous year. Net earnings show an increase of nearly 8 per cent. The earnings represent 14.2 per cent. of the average paid-up capital for the year of $18,275,000.

A Simple 2500-Volt Lightning Arrester

The Westinghouse Electric & Manufacturing Company, announce an addition to their line of lightning arresters in the form of a low-priced spark gap and resistance arrester known as the type CR. This is a single pole arrester for alternating current circuits of any frequency or capacity and for voltages up to 2,500. The arrester may be installed out of doors on poles or buildings, or indoors on station walls. The weather-proof metal case effectively protects the arrester units from rain or snow when installed in exposed locations.

The type CR arrester consists of a series of spark gaps between non-arcing cylinders in series with a resister. Four



New Type CR Arrester.

cylinders are used for the spark points so that in case of burning the cylinder can be turned to give a new arcing surface. The resister prevents the power arc that might occur on systems of large capacity if the spark gaps alone are used, making the arrester suitable for circuits of any capacity. The resistance is low enough to give good protection, but high enough to insure reliable operation, and to enable the non-arcing metal gaps to quench the arc at the end of the first half cycle. The resister material is a new composition that is absolutely unaffected in its resistance by static discharge. The discharge voltage is as low as is practical for use on 1,250 to 2,500 volt circuits. The manufacturers recommend one set of type CR lightning arresters at each distributing transformer with a minimum of five sets of arresters to the mile of line.

Every Contractor Needs One

The National Electrical Contractors' Association of the United States has prepared a standard system of bookkeeping forms for use by electrical contractors. We are of the opinion that many electrical contractors fail to make a success of their business because their system of keeping records and accounts is inadequate, and we strongly advise the adoption of the N. E. C. A. system or something similar. This bookkeeping system can be obtained from Mr. Geo. H. Duffield, secretary of the National Electrical Contractors' Association, 41 Martin Building, Utica, N.Y.

The Electrical Record, in a current issue, publishes a list of 300 uses for motors varying in size from 1½ to 5 h.p. No better evidence could be asked of the universal value of electric drive.

The Electrical News is printed in the interests of the man who buys and installs electrical equipment.

Toronto Hydro-Electric Commission's booth at recent Ideal Home and Electric Show, Toronto.

New "White Cross" Appliances

The illustrations herewith represent recent appliances placed on the market by the Lindstrom Smith Company, 1100-1110 South Wabash Avenue, Chicago. Fig. 1 is a table fan for use also as a centre-piece. It gives a breeze strong enough to be comfortable, but not strong enough to be annoying; operates on either d.c. or a.c. It is provided with a glass bowl on top, which can be removed at will. Fig. 2 is a 6-pound iron. Special care has been taken in the manufacture of this unit, which is constructed so that practically all the heat radiates to the point and edges, where it is most needed; no stand necessary, as iron can be tipped back; heavily nickel plated. Fig. 3 is an electric examination and vest pocket lamp, specially useful for doctors, dentists and nurses; can be carried in vest pocket or hand-bag, being no larger than a large pencil. The switch of the flash-light is used as a clamp to prevent it from slipping out of the pocket; also provided with tongue depressor easily slipped on and off; 5 inches long, 5/8 inches in diameter; a practical, powerful flash and examination lamp.

Fig. 1.

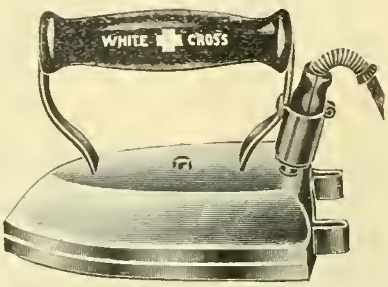


Fig. 2.

Fig. 3.

Make your windows sell your goods

In common with many other central stations, the Trenton Electric & Water Company, Limited, of Trenton, Ont., made a special Hotpoint electrical equipment display during the week May 3rd to 8th. The Trenton Company window display, reproduced herewith, was productive of very excellent results in the sale of grill stoves, irons, etc. Indeed, we understand that, as a result of this window's work during that period, the company have an additional load of 73 kw.

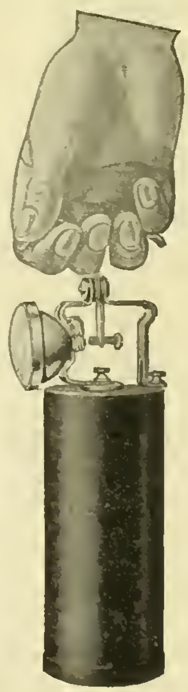
The width of the window shown is 11 ft.; the total depth, 5 ft. The card in the rear, where the figures are placed, is 5 ft. wide, and the sides tapered from 4 ft. to the edge of the front glass. The window was flooded with light produced by five 100 watt lamps, which made a very attractive night display and caused the different articles to stand out well on the black background.

The importance of the display from the standpoint of the central station is not, it must be understood, so much that a quantity of apparatus was sold, as that a constant load of 73 kw. was connected to the company's lines for all time. Further, this equipment, once placed in the house of their customers, would be the best possible advertisement and inducement for the purchase of further equipment. It is scarcely possible to over-estimate the value of these displays. Perhaps their efficiency is best proven by the fact that this method of getting business is most widely used where competition is keenest.

Window display that added a permanent load of 73 kw.

It is "Verilite"

We give below an illustration of the new "Verilite" battery lantern attachment, manufactured by the Duncan Electrical Company, Limited, Montreal. The makers claim for this, the only article of its kind made in Canada, that it is a strong and substantial device, with some special features.



The lantern centres on the battery.

The lantern centres on the battery, a point that is emphasized in view of the fact that most makes of this description are at one side of the battery when screwed in place. The attachment is readily placed in position and is held by two screws furnished with the battery.

For Ornamental Fixtures

The illustrations herewith represent the Hubbell-Caldwell No. HH-6158 rotating switch, which has just been placed on the market. This switch is designed for special ornamental lighting fixtures, where a projecting key or hanging chain might detract from the lines of the fixture. A sleeve

No projecting key or hanging chain —A sleeve with rotating movement makes and breaks contact.

having a continuous rotary movement engages a brass lip projecting from the segment, and this turns the light on or off. A special tripping mechanism makes it impossible to injure the switch by turning it the wrong way. This specialty is distributed in Canada by R. E. T. Pringle.

The Dealer and Contractor Section of the Electrical News is specially designed to assist the electrical contractor in his daily work. We endeavor to make it an "information" rather than a "news" department. To this end we continually feature such topics as new apparatus and best methods of installation of both lighting and power equipment and wiring, with a view to improving the standard of the contractor's work and the status of the contractor himself. $2.00 a year; one new, live idea may save you many times the amount.

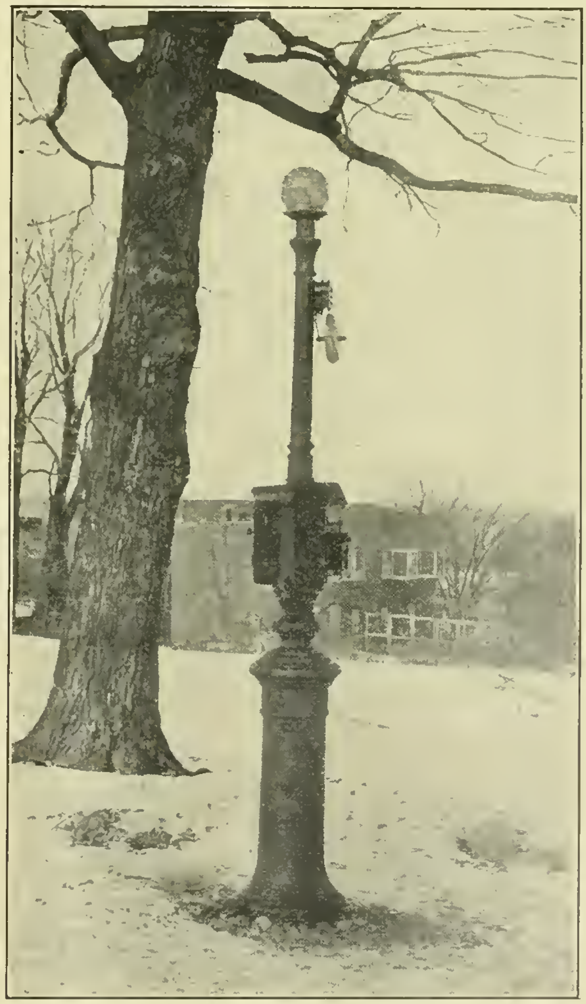
New Books

Electrical Instruments, by W. H. F. Murdoch, B.Sc., and U. A. Oschwald, B.A.; Whittaker & Company, London and New York, publishers; price, $2.50 net. This is a book dealing more fully with the theory of electrical instruments than do the ordinary text-books and is designed for students in higher university work and for practising and consulting engineers. In many cases, and especially in the section on electric supply meters, the results of numerous experiments are compared with theory. The book contains chapters devoted to the following topics: (1) Historical summary; (2) Electro-magnetic damping; (3) Permanent magnet moving coil instruments; (4) Iron cored instruments; (5) Electrostatic electrometers; (6) Hot wire instruments; (7) Dynamometers; (8) Supply meters; (9) Magnetic testing instruments; (10) Post-office box. Well illustrated diagrammatically; 360 pages, cloth bound.

Trade Publications

Sign Lighting—Bulletin No. 43,550, by the Canadian General Electric Company, describing Edison mazda sign lamps, with illustrations, curves of performance, wiring recommendations, etc.

Supply Catalogue—A well printed and illustrated catalogue of 88 pages has been issued by the Devoe Electric Switch Company, Mr. R. Moncel, manager, of 414 Notre Dame Street West, Montreal, manufacturers of knife switches, panel boards, switch boards, formed steel boxes, steel and wooden cabinets, and other electrical specialties. In the opening pages are outlined some of the conditions under which the business of this firm is carried on with directions as to the ordering of goods, etc., so that customers may know the conditions which obtain when dealing with the firm. The various types of switches, panel boards, etc., are illustrated, the cuts bringing out very clearly the details of the goods. General panel board specifications are given, with options and additions; also data for ordering. The catalogue is comprehensive in its information on all points connected with the goods of the company.



Fire alarm box, Police signal box and flashlight equipment, mounted on street pedestal, Outremont, Que.—Equipment by Northern Electric Company.

Current News and Notes

Battleford, Sask.

The Light Committee of Battleford are advertising for applications for the position of local electrician.

Burford, Ont.

Electric street lights were turned on in Burford for the first time on May 17th.

Belleville, Ont.

Nearly a hundred representatives of municipalities in Eastern Ontario met in Belleville on May 11th to discuss the problem of radial railways in this section. Mr. Hannigan, of Guelph, secretary of the Hydro-electric Radial Railway Association of Ontario, addressed the meeting.

Calgary, Alta.

Superintendent McCauley's report for the first three months of the year indicate that operating costs on the municipal electric railway system have been reduced from 17.63 cents per car mile to 14.41. The same report indicates that the net deficit for this period is much less than for the corresponding period a year ago.

Cartierville, Que.

The town of Cartierville, P.Q., is installing a water filtration system, which will be electrically operated. Two of the four pumps will be motor driven, the current being supplied by the Montreal Public Service Corporation. A rotary pressure blower will also be geared to a three-phase a.c. motor, Canadian General Electric or Westinghouse motors being specified.

Dorchester, Ont.

The Hydro-electric money by-law was carried at Dorchester by a large majority.

Exeter, Ont.

The Kirkton, St. Marys & Medina Telephone Company have applied for a charter, with capital $100,000.

Fournier, Ont.

The Prescott Rural Telephone Company, Limited, Fournier, have obtained a charter.

Ford, Ont.

The Ford Motor Company have placed an order for what will be one of the largest electric signs in Canada. The letters will be 15 ft. high and the completed sign 450 ft. long, outlining the words, "Ford Motor Company of Canada, Limited."

Hamilton, Ont.

The legislation sub-committee of the city of Hamilton, are considering a proposal to compel all electrical contractors to pass an examination before being allowed to accept city contracts.

Lynden, Ont.

A by-law will be submitted on May 31st, authorizing the local council to enter into an agreement with the Hydro-electric Power Commission of Ontario.

Niagara Falls, Ont.

The Canadian Niagara Power Company, of Niagara Falls, it is reported, are contemplating improvements to their plant to cost $3,000,000, which will include a new forebay to combat ice during the winter. It is proposed to take water from the river through large intake tubes. A dam will be built in the river to raise the water sufficiently to submerge the intake tubes.

Montreal, Que.

The Grand Trunk Railway has completed the installation of the telephonic train despatching system on its main line.

Outremont, Que.

The Outremont Council, P.Q., have asked a committee to confer with the Montreal Light, Heat and Power Company on the subject of municipalizing the domestic electric lighting system. The council recently installed a new system of nitrogen filled lamps for a section of the street light, and it is now suggested that the council might be able to come to terms with the company as to private lighting.

Pembroke, Ont.

The Pembroke Electric Light Company, of which Mr. E. A. Dunlap is president, have just installed in their power house at Black River a 625 kv.a., 60-cycle, 3-phase, 2,500-v., a.c. generator manufactured by the Canadian Westinghouse Company. This generator, together with formerly installed unit of similar capacity, should give ample reserve and the added service will be much appreciated by the citizens of Pembroke.

Ridgetown, Ont.

The electors on May 11th carried the hydro-electric by-law by a vote of 254 to 38.

Red Deer, Alta.

A by-law was recently passed by the town council, authorizing an agreement with the Western General Electric Company, which extends, for three months, the time required for giving notice of the termination of the present agreement.

Stratford, Ont.

Ex-Mayor Euler, of Berlin, district vice-president of the Ontario Hydro Radial Union, has sent out resolutions to municipal councils, for their endorsation, in Berlin and Guelph, and the townships of Waterloo and Guelph.

St. George, Ont.

A by-law was recently carried, authorizing the expenditure of $6,000 on the hydro distribution system.

Toronto, Ont.

For the first three months of the present year it is announced that the Hydro-electric Power Commission have added 3,000 h.p. to their power business.

Vancouver, B.C.

City Solicitor Jones has advised the civic fire and police committee that the city has no power to compete with the B. C. E. R. Company in furnishing electric power, until an offer has been made and refused to buy out the company.

Smiths Falls, Ont.

The Smiths Falls Water Commissioners have purchased a water power site on the west side of the river from Messrs. Woods and McEwan.

Sudbury, Ont.

A by-law will be submitted on June 14th, asking authority to guarantee the bonds of the Sudbury & Copper Cliff Suburban Railway Company to the extent of $75,000.

Windsor, Ont.

Representatives of twelve municipalities recently met in Essex County and formed the Essex Hydro Radial Association. Among other resolutions, the association pledged itself to use all legal methods to prevent extensions of franchises and charters to electric railway companies.

Electrical News
Generation, Transmission and Application of Electricity

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ADVERTISEMENTS

Orders for advertising should reach the office of publication not later than the 5th and 20th of the month. Changes in advertisements will be made whenever desired, without cost to the advertiser.

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Electricity at the "Fair"

The Canadian National Exhibition will be held this year from August 28th to September 13th. Each successive year our great Fair increases in educative and entertaining value. This year—Patriotic Year—we are promised that this record shall be maintained.

Did you, as an electrical man, ever stop to consider the value of electricity in this Exhibition? Or, to put it another way, can you imagine what this Exhibition would be like, stripped of its electric light and power? This is quite aside from the electrical exhibits proper, which in themselves constitute a very considerable portion of the attractions to the general public. Considering their obligations to "electricity," one cannot but regret that the management continue to ignore its claims to a building of its own, where models, not only of manufactured articles, but also of methods of installation, of wiring for light and power, different systems of illumination, indoor and outdoor, and so on, representing the results of scientific research and engineering practice at its best, could be displayed to advantage.

This year's general attractions will include such timely items as a "Grand March of Allies," "Model Military Camp," and "Airship Flights," including the dropping of bombs on helpless women and children (harmless bombs this time, however.) Giuseppe Creatore's band will delight lovers of music. The "Water Carnival" is said to include some unusually attractive features, and the "Midway" has been house-cleaned. In spite of the unfavorable conditions under which the management will necessarily operate this year, the outlook for the most successful exhibition in the history of this event is very bright. An interesting and timely attraction, it may be mentioned, will be an exhibit of war trophies.

Electric Cooking

Little by little the place of electricity "in the kitchen" is becoming established. Like many another innovation, suspicion and fear, rather than fact, has been a very real obstacle in delaying its recognition as one of the most powerful agencies in revolutionizing the internal economies of the modern home. Electrical men themselves have doubted even where facts and figures have convinced the layman. But we are started at last. A Canadian central station announces that they are selling ranges at the rate of one a week. None of them ever come back. It is like the farmer and his telephone—he installed it only under pressure but he holds on to it with bull-dog tenacity.

The moral seems plain. Electric ranges are their own best salesmen. To the central station men we would say—get electric ranges into the homes. Don't argue first cost, current consumption or operating expenses. The ranges themselves will answer all those questions. By and by even electrical men will become convinced that electricity in the kitchen is a good thing, easily competing to-day with the gas or coal range.

Defective Lighting?

In connection with our article published in the June 1st issue of the Electrical News, with reference to defective sight of school children, the following figures with special reference to the public schools of the city of Toronto will be of interest. In 1912 a comparatively small number of children were examined and the percentage of defectives was fairly low. However, in 1914, this percentage was more than doubled, though the number of children examined was very much greater. This probably finds its explanation in the changed attitude of the authorities towards this matter. The average given in the article mentioned above was 10 per cent., which compares with approximately 8 per cent. in Toronto. It must be understood, too, that this 8 per cent., representing, as it does, a considerable increase over the previous year, is subject to another increase for 1915, if the methods of examination become still more discriminating, and it is easily possible that the average for the present year will reach that mentioned for similar cases in the United States. The exact figures are given below in Table 1.

Table 1

	Complete Physical Examinations.	Cases of Defective Vision.	Percentage with Defective Vision.
1912	9,221	340	3.7 per cent.
1913	21,136	1,156	5.5 per cent.
1914	25,382	1,994	7.9 per cent.
Total	55,739	3,490	6.3 per cent.

Modern Economies

The Interborough Rapid Transit Company, of New York City, are removing four 7,000 kw. reciprocating steam units and replacing them by three 30,000 kw. units. The capacity will therefore be increased some 220 per cent., while the space occupied by these units will be the same. This is a matter of considerable importance where real estate is valued as highly as it generally is in the centre of our large cities. The guaranteed water rate of the reciprocating engines was approximately 17.3 pounds per kw.h., while the corresponding figure for the new unit, under full load conditions, is 11.63 pounds of steam per kw.h. The guaranteed water rates and

the Rankine cycle efficiencies of the new turbine units are given below:—

Table 1—Guaranteed Efficiencies of the Thirty Thousand kw. Turbines

Net kw. Load	Lbs. of Steam Per kw.hr.	Rankine Cycle Efficiency
15,000	12.07	70.73
16,000	11.94	71.51
18,000	11.77	72.54
20,000	11.54	73.98
22,000	11.40	74.89
24,000	11.30	75.56
25,000	11.27	75.76
26,000	11.32	75.42
28,000	11.47	74.44
30,000	11.63	73.41

The first of these turbines has been operating since December, and is said to have carried a load of 35,000 kw.

Assuming that the cost of coal is $3.00 per ton and the average evaporation is 8.7 pounds of water per pound of coal, the annual saving on a load of 25,000 kw. generated with one of the new units, as compared with the old units, is approximately $200,000 in fuel alone.

Montreal Filtration Plant

In connection with the Montreal filtration plant now under construction, plans have been drawn up for an electrical conduit system. The current will be supplied from the aqueduct, which has been enlarged for the purpose of developing power for the waterworks pumping plant, lighting, and other purposes. It is proposed to install the necessary equipment at the station at Point St. Charles, and to make the requisite connection with the filtration plant. The conduit will be 2,000 feet long. The plans include branch lines to outside lamp posts along the main line of conduit. Each joint of the terra cotta ducts is to be provided with wrought iron dowel pins. The uniform interior cross section of the vitrified clay ducts is to be 3½ ins. square with walls not less than ⅝ in. thick. The standard length of duct is to be 18 ins. The fibre ducts are to have an internal diameter of 3 ins., with walls not less than ⅜ in. thick. The ducts are to be laid in a 3-in. bed of concrete. Manholes are to be made at stated intervals. The contractor will have to install 40 cable racks each complete with five cable brackets.

Under a further contract, to be let later, the city will require a quantity of cable and also cast iron standards and globes. The cable will be 6,200 feet of 500,000 c.m. 2,500 v. single conductor power cable, 6,200 feet lighting and heating cable, 1,900 feet 0000B&S lighting and heating cable, 1,920 feet 2 conductor 220 v. varnished cambric outside lighting cable. All the cable except the latter are to carry 3-phase, 60-cycle a.c. The standards are to be of an approved design, while the globes will be of frosted or ground glass. The lamps will be 600 watt suitable for 220 v. single-phase a.c.

Electrical Prosperity Week

Sectional committees to supervise the Electrical Prosperity Campaign in the United States have been appointed by the executive committee of "Electrical Prosperity Week." Nearly 200 of the leading electrical men in the United States, representing every phase of the industry, have been invited to take part in local campaigns. It is estimated that the men on the various committees represent investments of about $2,000,000,000. These committees, co-operating with the Society for Electrical Development, will later designate additional committees in small cities and towns in the representative districts. It is hoped that, by the time the campaign gets into full swing in August, more than 60,000 electrical business men will be engaged in the common effort of boosting this idea.

New Electric Rates in Digby, N.S.

The Digby Electric Light Company recently made application to the Nova Scotia Board of Commissioners of Public Utilities for approval of certain changes in their tariff of rates. It was pointed out by the company that the system had been operating during the past year at a deficit, even leaving out of question all depreciation charges. Digby is peculiarly situated in that its summer population is practically double of its winter population, necessitating a plant of double the capacity that any other town of the same size would require. The following schedule of rates as approved by the board of commissioners is of interest:—

For churches, summer hotels, public buildings and short term users, at the rate of 20c. per kw.h. On such bills paid before the tenth day of the month, in which they become payable, the discounts following shall be allowed:—

On amounts up to $3.06 a discount of 5 per cent.

On amounts over $3.06 and up to $11.11 a discount of 10 per cent.

On amounts over $11.11 a discount of 12½ per cent.

No bill for electric current for such customer shall be rendered for less than the minimum monthly charge of $1.28.

All other customers shall be entitled to receive electricity at 18c. per kw.h. On bills paid before the tenth day of the month in which they become payable the discounts following shall be allowed:—

On amounts up to $3.43 a discount of 12½ per cent.

On amounts from $3.43 to $11.68 a discount of 15 per cent.

On amounts exceeding $11.68 a discount of 20 per cent.

No bill to customers entitled to these rates shall be rendered for less than the minimum monthly charge of $1.43.

When required, each applicant for service shall deposit with the company a sum equal to approximately two months' supply. The amount of deposit to be held by the company as collateral security for the payment of bills. Interest at the rate of 6 per cent. per annum shall be paid on all such deposits, and when the consumer ceases to use the supply and pays all bills, the deposit shall be returned with interest.

The company is required to furnish electric current from the usual starting time in the afternoon to 1 a.m. each day in the year.

The company agrees to furnish electric current for street lighting service, during the hours above set out in this order at the rate of $12.50 net per lamp per year on the basis of a minimum of fifty 40-watt tungsten lamps.

Telephone Dis-service

Under the heading, "The telephone dis-service," the Electrical Review has some interesting things to say about the telephone system in England since the property of the National Telephone was taken over by the Government. A particularly sore point with that journal seems to be that their telephone number has actually been changed. The Government methods are evidently not sufficiently conservative for our contemporary. Perhaps there is not the same incentive to such changes in England as in Canada, but really it might be taken as a hopeful sign, judging from the general tone of the Review's article, that something is being changed. We reproduce certain extracts which at least throw an interesting light on the success of Government ownership in the old land. Possibly the Review would be surprised to know that we have got so used to having our telephone numbers changed over here that we quite like it.

"To deny that the position of the telephone subscriber had changed for the worse would be shutting one's eyes to the obvious facts; the storm of protest, the agonized appeals for rescue from the tyranny and ineptitude of a State service that swept over London in 1912-13 will not soon be forgotten

by the telephone department, which itself was sorely tried by the necessity of coping with the difficulties of a gigantic and complex problem with an inadequate staff, under the control of laymen. Those who hoped for an all-round reduction of rates were sadly disillusioned; there is good reason to anticipate an increase rather than a decrease. The efficiency of the service fell so low that leading city men denounced it as a nuisance rather than an aid to business. Moreover, with the change of ownership came the accompanying change from the reasonable and co-operative methods of a commercial undertaking to the autocratic and arbitrary ways of a bureaucracy; the telephone service was no longer a convenience provided in return for a monetary consideration, but a privilege vouchsafed to those who succeeded in obtaining connections, subject to withdrawal on slight provocation and involving the user in unknown liabilities in the shape of payments for calls of unknown origin, the sole record of which was made by the Post Office staff.

"Our warnings and criticisms were issued in the interest of the general public, and not on our own behalf; but we are not to escape unscathed. We have just received a notice to the effect that our telephone number, which has become as familiar to our friends as the colour of our cover, is to be changed from Holborn 33 to City 997, 'owing to the acquisition by the State of the late National Telephone Company's system,' which has necessitated the rearrangement of certain of the exchange boundaries. There are no half-measures about it; arrangements are in progress for the transfer, and if we don't like it we can, of course, do the other thing. We hardly need point out to business men that the possession of a recognized telephone number, in spite of the deficiencies of the service, is something of an asset, like a known business address, and the arbitrary substitution of a new number is in effect an act of confiscation, without hope of redress."

Traffic Congestion and Electrics

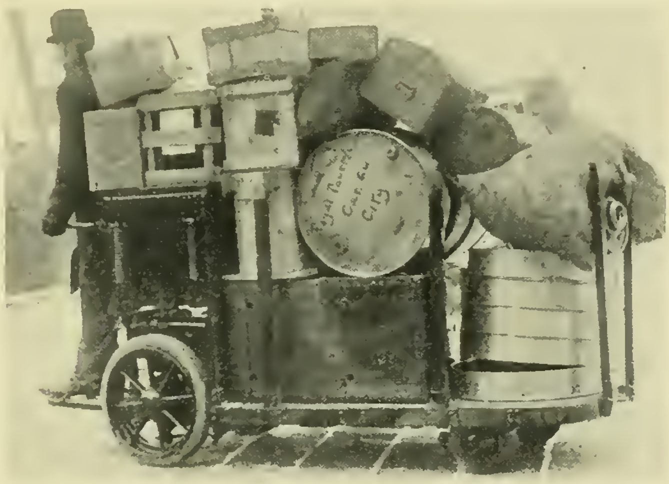
By A. Jackson Marshall*

That anything as distinctly modern and prosaic as an industrial truck could have a very interesting history seems rather unlikely, yet it is recorded that even the Egyptians and Assyrians had their industrial trucks—of a very primitive type to be sure—but efficient enough to carry some of the great blocks of stone used in building the pyramids. These early conveyances were nothing more than sledges which were dragged along roads smoothed and hardened specially to lessen the friction. Sometimes merely a forked tree limb with boards placed across it for a platform was used as a drag. Later friction was lessened by small rollers used on the sledge runners which in time developed into the wheel and axle—one of man's greatest contributions to world progress. This greatest of all mechanical devices was first used on one of these small vehicles by the Assyrians and soon developed the wheelbarrow and cart.

In America the genesis of the modern electric industrial truck is found in the necessity for an automatic device efficient enough to cope with the ever-increasing transportation of baggage and freight and with growing commercial industries. As terminals became larger and baggage rooms, post offices, and express depots became longer, a quicker and more capacious truck was demanded, and so one railroad—the Pennsylvania—engaged a mechanical engineer to design an electric hand truck, as it was then called. So successful was this application of the first "Electric Stevedore" that it was shortly applied to other operations.

When any mechanical device proves itself a labor and a time saver combining both efficiency and economy, it is only a short time before it becomes popularized, and beginning with 1911—only 4 years ago—various developments of the electric industrial truck followed each other very rapidly. To-day over 1,000 of these modern carriers are used in the United States and Canada. The average layman has but a small conception of the tremendous amount of work being done on piers, in railroad terminals, in industrial plants, by these powerful little storage battery trucks.

It is estimated that in the United States alone there is a grand total of 720,000,000 tons of goods every year which passes through the railroad freight and transfer stations. The present lack of system in handling this freight and the tremendous amount of lost time involved represents a yearly loss of more than $80,000,000. With the existing antiquated and inefficient methods there is constant confusion and delay where thousands of conveyances endeavor to get served within a few hours. This causes the transfer mediums to be held up for several hours inactive with resulting losses. As the use of the "Electric Stevedore" increases, it is to be hoped that this will influence a further systematized manner of delivery. As their work becomes more thoroughly unified, the freight sheds and docks in many cases will operate on a 24-hour schedule. With the virtual freedom of city streets great electric commercial vehicles operating silently, will transport the goods by night to well located centres



The Electric—One doing the work of many.

from which goods may be distributed the following day and delivered when business houses are prepared for their receipt. This seems to be the only way to solve the problem of congested freight piers in cities where increase in size of the terminals is rendered impracticable for physical reasons, the cities in most cases having steadily built up around them. To-day the only hope for decreased congestion is increased efficiency such as will enable street vehicles to discharge or receive their loads with celerity, and this must be effected by speeding up the movement of freight over the platforms, in using more efficient transfer means between the vessel holds or freight cars and the vehicle tail-boards, and in organizing a system of distributing centres to supplement the cramped terminals.

In railway terminals alone where these modern electric carriers have supplanted the hand trucks it is estimated that there is a total saving of 66 per cent. The electrically propelled baggage truck has proved itself a fixed necessity. We have ceased to marvel at the speed, ease and efficiency with which these trucks piled high with trunks, bags and boxes deftly wind their way along congested station platforms from train to baggage room, doing the work that formerly required four times as much labor and twice as many trucks. A short description of the operation of an electric industrial truck will show its simplicity and safety. The controller is inclosed and an automatic cut-off switch mini-

* Secretary, Electric Vehicle Association of America.

mizes accidents. One handle is used as a controller lever, and the other handle for steering. The controller returns to neutral as the hand is removed from the lever. The cut-off switch cuts off the power when the foot is removed from the brake pedal. In other words the driver applies the brake simply by releasing the pedal with his foot, and as he releases the pedal, the power is cut off automatically.

The driver, standing erect on the end of the truck, with hands on the controller and steering lever, respectively, and foot on the brake pedal is in the best possible position to guide and control his load. The simplicity of operation does away with the necessity for having expensive operators, the average freight handler being taught to successfully operate a truck, even in congested plants or terminals, in about 48 hours. The ordinary baggage truck has a capacity of 2,000 lbs., and is used for carrying both baggage and mail. The immense increase in baggage, express and mail matter being moved by our railroads demanded proportionate increase of efficiency in its handling, and slow moving man-powered hand trucks have gradually given way to the modern "Electric."

Supplanting the Hand Truck

Time studies made in manufacturing plants and at the great piers in seaport cities indicate beyond a question that "Electric Stevedores" will supplant the hand truck wherever operating conditions warrant. More than this, the shipping platforms and piers of the future will be designed especially for the more efficient operation of these electrics. They already have a tremendous influence on the short haul.

Down in Savannah you may see cotton moved across great piers by "Electric Stevedores" equipped with hoists and cranes, carrying it directly into the holds of the steamers which bring it north. Two of these little electrics would handle more cotton in one day than twenty freight handlers. At the Bush Docks in Brooklyn you can see the same cotton placed in cars by battery truck cranes, the cars first being "spotted" by the electric. It is taken out of the cars at the mill by the industrial trucks and moved to storage and then to spinning room by them. Later the bobbins, dye tubs, and beams are moved from mill to mill by small electric shop trucks.

The Commercial Vehicle in a recent issue cites an excellent example indicative of the economy of operating these "Electric Stevedores."

"In testimony submitted for the information of the Interstate Commerce Commission, a report of the operation of an electric industrial truck at the Cunard pier, New York City, showed that in handling macaroni in boxes, six electric industrial trucks did the work in nine hours, that would have required 24 hand trucks. The cost of labor with the electric vehicles was $21, while at current longshoremen's rates it would have cost for labor, $87.60, if hand trucks had been relied upon.

"In handling grapes in barrels at the same dock, two industrial trucks did the work of 21 hand trucks. In handling mackeral in barrels, two electric industrial trucks did the work of 19 hand trucks. In handling casks of wine, seven electric industrial vehicles with thirteen men, did the work of 36 men rolling the casks from one man to the other."

Costs Less Than Half

Under the old method of hand truck operation, the cost per ton of handling freight at railroad terminals and steamship piers was 25c., while the cost per ton for performing the same work with electric industrial trucks is but 10 1-3c From a socialistic view, too, investigations show an important feature which particularly commends the "Electric Stevedore" to the operator as well as to his employer. Under the old plan the men received a wage of $2.00 per day, while under the truck operating system, where men are paid on a tonnage basis, their compensation amounted to $2.40 per day, or an increase of 20 per cent.

While the largest field for the "Electric Stevedore" is in handling baggage and freight at terminals and piers, they are being used to a great extent, however, in factories and industrial plants, and more and larger installations are being made continually. In shop and mill transportation, in storage warehouses, in freight transfer stations, in supply and provisioning work for railroads, steamships, etc., in brick and lumber yards, in stoking in power plants, in wholesale and retail packing, shipping and receiving, and even in building operations the electric industrial truck finds extensive application. A valuable application of the "Electric Stevedore," equipped with a crane, is in laying street curbstones. In warehouses they are used for hoisting, in packing motors, etc. Motor car, and other manufacturers, are beginning to regard the electric shop truck as indispensable. Warehouses and mills are constantly finding new uses for them as the number of different types increases. The Government has adopted them for its arsenals, and a recent special application is found in the new buildings of the Boston Children's Hospital. It is being employed to do the work formerly performed by 4 men. "During its nine months of service, not one dollar has been spent for repairs on this useful vehicle," states the Electrical World. "The truck is used for the transportation of food from the kitchen to the elevators, for collecting and distributing washing, and for other odd jobs, and is operated in all about 20 miles per day. It is geared to run at 6 miles per hour, and is charged every other day with energy supplied for the central power plant of the Harvard Medical School."

Trucks for All Requirements

According as necessity has created the demand, various types of these trucks have been developed. They are made small enough to operate in the aisles of factories, and storage warehouses, yet they carry from one to two tons, the latter being standard capacity. They possess sufficient power to haul trains of trailers, and they can climb grades that would tax the power of mules, and would be impracticable for hand trucks. Elevating transfer trucks have been developed by which it is possible to pick up, carry away, and set down, interchangeable false platforms with piles of goods on them by automatic means, thus eliminating the last item of hand labor, the loading and unloading of the trucks.

It should not be overlooked that this small truck has many of the fundamental advantages of its larger brother in the street, namely, it is clean, odorless, and practically silent, its simplicity of construction is a great aid in operation and maintenance, and its freedom from fire and explosion commends it to fire commissioners and underwriters.

It is obviously too early to determine to the last cent just how much can be saved by the adoption and use of these small trucks. The labor item is the most important one, and it has been found that where the trucks can be kept busy and the hauls average 200 to 800 feet, that each truck will displace at least 4, and often 5 and 6 men each. They can make from 20 to 30 miles on a single charge, while boosting during noon hour will increase this mileage one-third. Although the initial cost of the electric industrial truck, which is $1,000 to $3,000, looms large when compared to the cost of hand-powered equipment, it will save its first cost in 4½ months with careful operation, and if a machine will pay for itself in this short time, what does it matter whether it costs $1,000 or $5,000? With enough work to keep it busy, and with careful operation, the economy and capacity of the "Electric Stevedore" is little short of amazing.

The Pelton Water Wheel Company are distributing a small illustrated pamphlet describing their exhibit at the Panama-Pacific International Exposition.

The Electric Lighting Industry

By C. W. Stone*

The electric lighting industry, so-called, has grown so rapidly and has expanded in so many directions that it will be possible to point out only a few of the factors which have contributed to its growth.

The industry, considered as such, may well be called one of our infant industries from the point of years since its inception, but from the point of view of its magnitude it is probable that no single industry is of such vast importance to modern civilization. It is no longer a scientific toy or luxury, but is a vital necessity to our present progress and will become more so as we advance.

The Gramme dynamo completed in 1871 is usually referred to as being the first type of machine to be used commercially for arc lighting, but other work had been done with other forms of machines which were fully as successful. Progress in Europe was rapid in the earlier days, but the greatest progress later was on our own continent. Probably the first commercial arc system installed in this country was in Cleveland in 1879. Immediately after this other systems were installed both in this country and in European countries.

In the earlier days the problems of successful lighting were many. It was not only a problem of building machines for the production of the electricity, but instruments, switch, etc., had to be developed, no continuous lengths of copper wire were available, and in fact the engineer was confronted with the most difficult problem possible. Everything had to be invented, but the interest was so great that many inventors were attracted and the financiers were liberal in their support, which resulted naturally in very rapid advance.

Most of the early work was on the development of arc machines and arc lamps, and it was about 1883 that companies were formed to take contracts for lighting city streets, the price being about $1.00 per lamp per night. Many difficulties arose, such as poor and crooked carbons, poor and thick globes, unskilled labor for the construction of both lamps and machines and their operation.

It was soon recognized that the arc system was the best suited for special lighting and particularly for out-of-door work. Mr. Edison then experimented with the development of the incandescent lamp and after many experiments success was reached.

First incandescent in 1882

The history of this type of lamp has been described so many times that it is unnecessary to describe it here except to point out the date of the starting of the first commercial station for this type of lighting at Appleton, Wis., in August, 1882, the total capacity of the station being for two hundred and fifty 10 c.p. lamps.

At this time the systems for arc and incandescent lighting were wide apart. Arc lighting, due to its fundamental characteristics, was suitable for outdoor service lighting, especially in stores and manufacturing plants, while the incandescent system with its low-voltage circuits and small lamps was naturally limited to small areas and indoor service. These two systems of lighting, each with its own admirers, naturally led to rivalry and competition. At the same time, new schemes and contrivances were developed that would bridge the gap existing between the series and multiple system in service; while some of these were quite ingenious, they only proved temporary and gradually paved the way for the introduction of our modern alternating current system, which perhaps more than any other factor has helped to develop a uniform electric illumination and power transmission. The alternating current system began to receive prominent attention about 1883 and in the fall of 1885 the first regular alternating current system was installed at Buffalo, N.Y., when current was generated at 500 volts and stepped up to 3,000 volts for transmission, after which it was stepped down to 100 volts for service. Even this installation was crude in a good many respects.

The development of the polyphase generator, which was the next step, permitted the development of the polyphase induction motor with its high starting torque and rugged simple construction.

From this time the growth of the central station was rapid. The value of a day load was soon apparent, campaigns were immediately inaugurated to develop power applications. This resulted in the rapid increase in the size of the central station and created a demand for larger generating units. This demand later brought about the rapid development of the steam turbine. The first large units, 5,000 kw., were built in 1900, and the capacities have steadily increased until to-day turbines are in operation of 30,000 kw. capacity, and 50,000 kw. machines will probably be built within a short time.

Centralization of generating plants

It is not in steam turbines alone that this increase has appeared. There are in operation to-day waterwheel-driven generators of over 17,500 kw. continuous capacity. With the increasing demand for electric service and the development of larger waterwheel-driven alternators the water power companies have gone farther back into the mountains for their water power sites until we now find such stations 250 miles or more from their distributing centres and operating transmission lines at 150,000 volts.

In the control apparatus the development of the oil switch has kept pace with the increase in capacity and voltage until to-day the oil switch not only breaks a potential of 150,000, but will withstand line disturbances of three times this value.

Before the introduction of electricity, manual labor was almost supreme because the mechanical devices in service were usually so crude that they required almost constant attention for successful operation. During this period many wonderful inventions were nevertheless perfected, but their requirements were for very special conditions of necessity to meet a particular requirement without having direct bearing on the welfare of the entire community.

The introduction of the central station for the general distribution of electricity on the other hand marked a decided step in the advancement of civilization, because through this medium it has been possible to generate power at a cost so low and in such convenient form that it is rapidly displacing all other forms of power.

During the early stages of progress central stations were developed mainly for lighting purposes and, like all new business enterprises, the greatest activity was developed in communities of sufficient size to plainly warrant the expense. The outcome of all these years of development has finally resulted in the successful installation of about 8,000 electric lighting plants in continental United States.

The tendency in the past has been the building of a central station for each locality, but this idea is being gradually replaced by the more economical system of distribution, namely, the generation of large quantities of energy at some central point or the consolidation of several central stations and distributing the energy at high potentials to other communities where it is again distributed at safe voltages for various purposes; for instance a large city plant expands so as to include all the district around it and service originally limited to a small area is unified over a considerable territory. In other cases the individual properties in a territory are merged and brought under one management, while other instances occur where unrelated public service com-

*In General Electric Review.

panies widely dissociated in various states are placed under one control and management. This system of development has now progressed until the electric properties have merged their interests in other utility properties, such as the gas and street railway systems. The relative economic advantage of this method of operating must receive universal approval because it is of direct interest to each individual and has a direct bearing on the low price of electric energy.

Using the diversity factor

One of the most important advantages of this method of operating is the utilization of the diversity factor which is one of the primary elements in determining a low price for electric service. The station must be designed to carry the maximum demand, but the cost of the power will depend upon its average 24 hours' demand.

The utilization of electrical energy in a modern city home has reached such a stage that it is now used not only for lighting, but for heating, cooking, cleaning, refrigerating, operating mechanical drive such as fans, washing machines, etc., and almost every other conceivable purpose. In a similar manner everything in which man is interested has been benefited and the rapid development of electricity along diversified lines has added immeasurably to the progress of civilization. In medicine and surgery it has proved of inestimable value. To-day we have the Rontgen ray which is of great assistance to surgeons in locating various troubles in the organs of the body, thus simplifying the necessary operation and greatly reducing the time required, and in some cases making it possible to avoid operating.

The X-ray is now being successfully used in metallurgical research, as by its use faults in metal substance can be shown. Electricity is also used for cauterizing wounds in the purification of air and water by the ultra violet ray. The moving picture was made possible by the development of the high powered arc lamp.

Among the farmers

These benefits are by no means confined to the city because the central station with its great network of distribution is in a position to furnish electric energy to the farmer, who, if progressive, is to-day able to enjoy the same pleasures as his city neighbor, and in addition can accomplish a greater amount of work than heretofore in less time and at a smaller cost. Another important direct benefit is that it does away with practically all the old drudgeries usually found about the farm.

The technical growth of this industry has brought out many interesting problems tending to reduce to a minimum the overhead operating and distribution charges, so that electrical energy may be produced and delivered at the lowest possible cost. The details involved are numerous and complicated even from the proper handling of the coal for the boilers to the delivery of energy to the lamp filaments in the home.

In attempting to prophesy the future of an industry one naturally looks to the past for guidance, although in this age of scientific investigation and discoveries there are possibilities of such radical changes as may upset all prophecies based on past conditions.

It is interesting to note, however, that in the last 20 years the increase in magnitude of the central station industry has been at the rate of about 15 per cent. per year or doubling itself every five years. If lighting alone is considered, although the point of saturation is far from being reached, we should not anticipate a continuation of increase at this rate. The central stations are, however, making every effort to increase their output and diversify their load by use of current for every conceivable purpose and a reasonable rate of increase in load will be continued and possibly be increased.

Hand to hand with the growth of the industry has gone a reduction of the cost of lighting and of power, both of these movements being related to each other reciprocally as cause and effect.

It is to be expected that the reduction in cost of electricity will be continued as new discoveries and improved methods of generation, distribution, and conversion are adopted, although as the theoretical limits are approached, the decrease in cost will not be so rapid as it has been in the past.

Generation

With the improvement in load factors and the increase in size of generating units and generating plants and systems, it is to be expected that improvements and refinements in the various generating station operations will be made. Some of these possibilities are as follows: The utilization of a greater temperature range in the thermal cycle, as by higher degrees of super-heat, the increased use of economizers, etc. One very important improvement already in sight is the mercury boiler and mercury turbine worked out by Emmet. In this development coal is used in a special boiler evaporating mercury. The mercury vapor is expanded to a high vacuum in passing through a turbine producing power, the condenser for the mercury serving also as a steam producer whence steam is carried to steam turbines, thus the mercury is worked through the thermal cycle from about 700 deg. F. to 400 deg. F., the steam working through a cycle from 400 deg. F. down to 70 deg. or 80 deg. F. The addition of the mercury cycle to the steam cycle enables us to produce from 35 to 50 per cent. more power from a pound of coal than is at present produced by the most efficient steam generating stations.

For small and moderate sized plants the high efficiencies shown by internal combustion engines, particularly of the Diesel type, will probably produce an extension of the use of such machines as soon as improvements of design and standardization of manufacture sufficiently reduce the initial and maintenance cost.

The design of internal combustion turbines is a field having large possibilities but surrounded by apparently insuperable difficulties, to which a solution may possibly be found in the future.

Engineers are turning their attention to methods of utilizing all of the heat generated by fuel, and along this line efforts have been made to utilize the heat of exhaust from the heat of internal combustion engines. A notable example of this is to be seen in the Ford factory.

Distribution

There is a considerable field for improvement in methods of distribution. Developments of the past few years show an increased tendency to connect together a number of generating stations into a network and these stations may be steam stations or hydraulic, or more frequently both. The extension of this network supplied from numbers of central stations will undoubtedly increase. We already have transmission and distribution networks covering several states and the future will probably see the whole country covered by distribution networks connected together by transmission lines, just as the steam railroads have been interconnected. Improved methods of protecting these networks from lightning, high frequency, short circuits, etc., will be developed.

Our knowledge of properties of insulating materials is as yet imperfect. Investigation and discoveries will probably produce considerable improvement in the insulation of conductors and thus allow the use of higher temperatures and higher voltages tending towards reduced losses and economy of investment in the distribution system.

Sub-stations

There has been a steady reduction in the weight, size, and cost of electrical apparatus for sub-station use, enabling

the central stations to make considerable increases in the kilowatts per square foot of floor space. These changes have been brought about by improvements in design, economizing in material and the use of increased speeds. It seems likely that some progress will still be made along these lines but there is not very much room for improvement unless new types of apparatus are developed. Such new types as various kinds of rectifiers are being studied and may prove useful in the future.

The automatic operation or the remote control of sub-stations has proved successful in initial installations, both in lighting and railway work. The constant demand for economy in operation is likely to extend to the use of this class of sub-station.

Lighting

Vast improvements have been made in the past few years in incandescent and arc lamps. The former are now approaching limits fixed by the temperature of melting point of tungsten and others of the most refractory metals. There is no limit, however, to the temperature of incandescent gases, hence the arc lamp offers a field for improvement limited only by the present methods.

A still greater field for improvement is a possibility of the production of light without heat. At present in all of our lighting most of the energy applied to the lamp goes into heat, only a small amount is turned into light. For instance, in the half-watt gas filled mazda lamp, which works at about 0.62 watts per spherical candle-power, the luminous efficiency is about 3.3 per cent., that is to say, only 3.3 per cent. of the energy applied to the lamp is put into the production of light, the remaining 96.7 per cent. being dissipated as heat. The most efficient arc lamp has about 5 per cent. luminous efficiency. Thus we see that in spite of the great progress that has been made, there is still a vast field for improvement in the transformation of electricity into light, and so offering a field for improvement greater than any of the other steps in the generation and distribution of electricity and its conversion into light.

Power Plant at the Hotel Vancouver

By George T. Thirsk*

The rapid growth in population and business of the metropolis of British Columbia in recent years has created a big demand for hotel accommodations. This demand has been met by the construction of a great number of hostelries. Prominent in this new development stands the Hotel Vancouver, which, on account of its location at the junction of the transcontinental railroad and Oriental and Pacific Coast steamship lines, under the control of the Canadian Pacific Railway Company, occupies a position of vital importance in the chain of hotels owned and operated by this company.

Characteristic of its policy to make ample provision to meet the demands of progress throughout its entire system, the Canadian Pacific Railway Company in 1912 began the construction of a new and capacious building on the site of the old hotel. It is more advantageously located on the brow of a hill overlooking the harbor. This location is further enhanced on account of the wonderful panoramic view of the city, the various bodies of water, the hills and snow-capped mountains that are within one's vision from this point. The original hotel building was constructed in the form of a letter "L," and in a separate building at the rear was located the power plant and laundry. From the beginning, the exhaust steam from the various units in the power plant was the chief factor in the heating of the hotel. It was also used for drying purposes in the laundry.

As the pace in the growth of the city warranted, new sections were added to this hotel, and the power plant was correspondingly increased. To provide accommodations which would otherwise be curtailed during the construction of the new hotel, a large apartment building was erected in the form of a letter "L" on one of the rear corners of the hotel site. The hotel business was continued in operation throughout the entire construction period. The sections were razed one at a time as the work of construction progressed, until at the present time a magnificent structure occupies the entire site.

The first work to be undertaken was the erection of a new power plant and laundry building. A seven-storey structure of reinforced concrete was put up at the rear of the apartment building and apportioned as follows: Basement and first floor—boiler plant and chief engineer's office; second floor—departments of maintenance; third, fourth, fifth and sixth floors—laundry; and seventh floor—living quarters for engineer's staff.

The engine room was laid out to take advantage of space not otherwise usable, and occupies the areaway under the lane on the hotel side of the power plant and extends at right angles to the rear of the hotel.

The original plans of the hotel were drawn up with a view of installing hydraulic elevators throughout, and elevators of that character were installed in the apartment building and power plant.

The source of supply for all other power was to be derived from a 110-volt direct-current two-wire system. With the exception of one generating unit the equipment in this power plant was new and consisted of the following: Three 400 h.p. Babcock & Wilcox water tube boilers, all necessary boiler auxiliaries; two 175 kw. 110-volt generators, direct connected to vertical compound engines; one 75 kw. 110-volt generator, direct connected to a simple side crank engine (This unit had been in service in the old plant for 10 years); one 5-panel switchboard consisting of 3-generator and 2-feeder panels; one horizontal duplex pump for elevator service; one vertical duplex pump for house service; and two 25-ton refrigerating machines and condensers.

This plant was put in operation early in the year 1913. Since that time conditions have arisen which warranted the abandonment of the installation of hydraulic apparatus and necessitated the adoption of the electric drive for the elevators in the new hotel.

As none of the power-driven appliances throughout the hotel had been contracted for up to this time, and as the electric wiring installation throughout the hotel building had but reached its preliminary stage, a complete revision of the entire power and lighting equipment was made with a view of establishing the plant on the most economical basis possible, consistent with the changed conditions.

After due and careful consideration of all of the problems involved, it was decided to convert the plant over to the 110-220 volt 3-wire system for lighting, all motors in operation at that time and those on the new schedule of 1 h.p. in size or less to be wound for 110 volts and the remainder to be wound for 220 volts. While it is a recognized fact that in the majority of 3-wire installations, isolated 2-wire 110-volt block loads are apt to produce unsatisfactory balance conditions of the system, it was possible at this plant, at a small

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expense, to rearrange the existing 2-wire feeders so as to maintain a satisfactory balanced condition.

To revise the plant to meet all the new conditions presented a problem that was complicated in the extreme, inasmuch as it necessitated a considerable rearrangement of apparatus and a complete change of feeder distribution. Provision for every possible emergency was made and the work conducted without interruption in the operation of the existing plant.

Briefly, the new arrangement included three 100 kw., 110-220 volt turbo-generators, and a new 8-panel switchboard. The 75 kw. generator was removed and one refrigerating machine and the two large pumps were moved to other locations, so as to make room for the turbo-generators. A new switchboard consisting of five generators and three feeders replaced the old board, and was located on the same foundation.

The engine room was laid out in the form of a letter "L," the 175 kw. units occupying the base, the switchboard in the corner and the other apparatus beyond in the following order: Three turbo-generators, two refrigerating machines and condensers, vertical pump and horizontal pump. The boilers are located below the base of the "L."

Boiler Room Installation

The boiler plant comprises three 400 h.p. Babcock & Wilcox water tube boilers, manufactured at Renfrew, Scotland, each being built up of 14 sections of thirteen 4-in. tubes, 18 feet long. These boilers are designed for a working pressure of 190 lbs. Each boiler is equipped with Babcock & Wilcox forged steel super-heaters, designed to give 75 degrees Fahr. superheat at the boiler nozzle. Each boiler is equipped with Hammel patent fuel oil furnaces, which are a modification of the Peabody furnace in that they permit of individual ducting of air to the burners.

The burner control valves are located at the boiler front, the pipes conducting the steam for atomization and

Front view of Switchboard, Hotel Vancouver.

the oil from the control valves to the burner tips passing under the furnace floor through that part of the setting commonly known as the ashpit. In this manner the burner tips are located at the bridge wall and throw the flame towards the front of the boilers. As the furnace increases in volume from the bridge wall towards the boiler front, this arrangement gives the greatest effective furnace volume as the flame can entirely fill the furnace without direct impingement on the tubes, the possibility of blow-pipe action, or the lack of complete combustion due to premature cooling of the products of combustion.

The boilers are also set with extra high furnaces so as to permit the most economical combustion of coal on chain grate stokers should the relative prices of coal and oil make it desirable to use coal fuel. Provision is made throughout the boiler room for the easy handling of coal and ashes by labor-saving devices, conveyors and ash and coal hoppers. When coal is used as fuel, chain grate stokers will be installed and fed by gravity through spouts from reinforced concrete hopper bottom bunkers installed immediately above the boiler room. The ashes will be conveyed by bucket conveyors to a reinforced ash hopper, from which they can be drawn by gravity into auto trucks located in the areaway. The coal will be brought in by similar trucks and will be automatically dumped into a distributing hopper, from which the bucket conveyors used for handling ashes will also elevate the coal to the coal bunkers referred to above. With these provisions it will be possible to operate the entire plant with coal fuel and one fireman, the same as is now used in connection with the operation with oil fuel.

Oil Pumping Set

In connection with the burning of oil fuel as now installed there is provided one double Witt oil pumping system of ample capacity for the operation of 1,400 h.p. of boilers to rating. This set consists of two special duplex brass fitted oil pumps mounted on a cast iron tray over a special condenser type of heater, thus making a compact self-contained pumping system unit. This oil pumping system is fitted with relief valve, lubricator, gauges and other special oil appurtenances.

The oil storage tanks are located underground outside the boiler room wall.

The operation of the plant with oil fuel is under the control of a Moore automatic fuel oil regulating system. This system, the invention of C. R. Weymouth, chief engineer for Chas. C. Moore & Company, Engineers, and J. R. Atchison, superintendent of construction for the same concern, is a comparatively new development in the economical handling of oil as fuel, and contributes largely to the excellent economy obtained in this station. The ease with which this is accomplished renders the description of this system of considerable interest to the combustion engineer as well as the power plant operators.

When the load on the power plant increases, either suddenly or gradually, there is an attendant drop in steam pressure. By means of a diaphragm subjected on the one side to steam pressure through the medium of a water cylinder, and to the pressure on the oil line to the burners, an exact control can be obtained of the oil pressure to the burner through the medium of properly arranged balancing weights, levers and control valve. When an increase in load produces a slight decrease in boiler pressure, the reduction in boiler pressure immediately increases the pressure in the oil line, and therefore the amount of oil supplied to the burners, with a corresponding increase of heat generated in the furnace, which will raise the boiler pressure to that for which the automatic system has been previously set. Conversely, should the load drop off suddenly, increasing the boiler pressure, the system operates to reduce the quantity of oil burned and thus decreases the boiler pressure. Proper damping arrangements are made so as to prevent hunting and a steam pressure practically uniform, as shown on recording steam pressure gauge charts, is secured. This constant steam pressure is very desirable, but of minor importance compared to the other functions of the automatic fuel regulating system. As the quantity of oil being burned is increased, it is also important that the quantity of steam for atomization of the oil be increased in the proper proportions. It

has been found that the proper ratio of steam to oil is not constant, and it was therefore necessary to devise a regulator which would give the proper relation at all loads. This was secured by using a modified form of Leslie reducing valve, by means of which the steam pressure obtained at the burners for purposes of atomization becomes a function of the oil pressure in the oil-to-burner line. It was found that if the oil-to-burner and the steam-to-burner pressures were plotted, the steam-to-burner pressures could be shown on a straight line curve cutting the axis of abscissa at a point above the origin, corresponding to the amount of steam pressure necessary to break up the oil on no load. Equally important is the control of the air supplied to the furnace, and a damper regulator operated by the variation in oil pressure is also installed as part of the system. By the proper co-operation of these three units in the regulating system the best possible evaporative results are secured. This regulating system has excited considerable interest throughout British Columbia, and has been adopted by the British Columbia Electric Railway in its two steam stations.

Auxiliaries

The feed water is supplied the boilers by two Weir boiler feed pumps. These pumps handle the returns from the heating system and make-up water which is heated by a 1,000 h.p. capacity Cochrane feed water heater. The returns from the heating system are pumped to the feed water heater by two Burnham low duty vacuum pumps. A motor-driven submerged type of centrifugal sump pump located at one side of the boiler room, drains the ash tunnel and low points of the boiler room floor.

Service and Elevator Pumps

The water supply is maintained by a twin compound Weir vertical service pump, and the hydraulic elevators are supplied by a Burnham horizontal duplex pump.

Generating Equipment

There are two 175 kw., 110-volt direct current compound wound commutating pole type generators, manufactured by the Canadian General Electric Company, which are direct connected to Robb-Armstrong vertical compound engines running at 400 r.p.m. These generators are so connected that they may be operated in series on the 3-wire system or independently on an emergency 110-volt bus, the functions of which are fully described later on.

The new electrical equipment consists of three 100 kw., 110-220-volt, 3-wire turbo-generators, manufactured by the General Electric Company and operating at a speed of 3,600 r.p.m. These generators are compound wound, commutating pole, each having two series fields on opposite sides of the armature and necessitating two equalizer connections for parallel operation. For deriving the neutral connection, each generator is provided with a compensator located close to the generator.

The turbines are of the Curtis type and are equipped with all of the latest improved features.

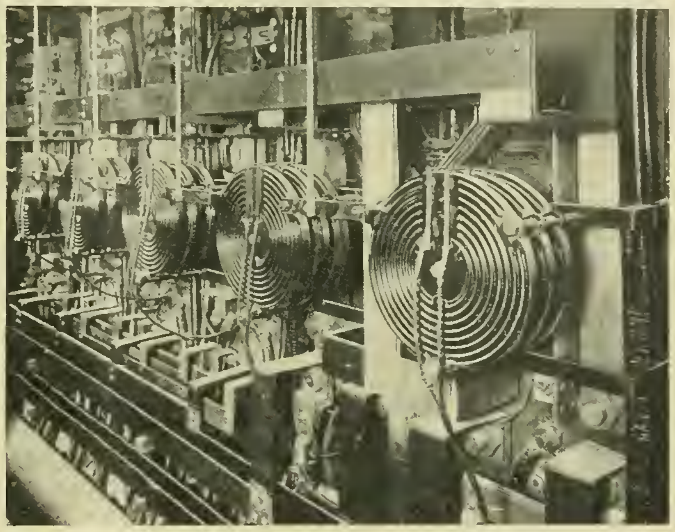
The combined units have attracted considerable favorable comment on account of the compactness and neatness of design.

As the various buildings, including the Opera House block, which is also served with light, heat and power, are heated by the exhaust steam from the combined units, the engines and turbines are at present operated non-condensing. However, provision has been made to equip the turbines with a condenser so that they may be operated condensing during such periods as the amount of exhaust steam is in excess of that required for heating.

Refrigerating Apparatus

The refrigerating plant consists of two 25-ton ammonia machines, manufactured by the Canadian Linde Company. The compressor cylinder is arranged in tandem with the steam cylinder. The condensers and brine coolers are of the double pipe type.

Brine circulation is used throughout the entire system of refrigeration, while direct expansion is used in the ice-making tank which has a capacity of 5 tons per 24 hours.



Rear of main Switchboard, Hotel Vancouver.

The brine circulation system is very complete, including refrigerators on each floor.

Switchboard Equipment

The switchboard consists of 8 panels of uniform size, 66 x 24 ins., with sub-panels 24 x 24 ins., or a total dimension of 16 ft. by 7½ ft. The material used is the best quality of slate, 2 ins. in thickness and painted with Egyptian lacquer so as to present a lasting dull black finish which harmonizes perfectly with the polished copper appliances mounted thereon and is free from the attacks of oil and dirt. The board rests on a 6-in. channel iron base partly embedded in the cement floor and is supported by a 2-in. angle iron frame braced from the wall by material of like character.

The board was designed with a view of locating the instruments and switches in the most natural position for the convenience of the operator, and in the accompanying illustrations it will be noted that the instruments are on a level with the eye, and the switches are at the proper height for the average person.

Beginning at the left, the first five are generator panels, being connected in rotation according to their location. Following these are the panels for 220 volt power, 3-wire lighting, and 2-wire lighting and 110 volt power. The last panel on the right provides connection for the old 2-wire system and double throw switches were used to permit the interswitching of feeders in the event that any undue unbalance on the system should arise.

The circuit breakers on all generators are connected between the generator and main switch and those on the turbo-generators are actuated only by the armature current.

The main or 3-wire bus-bar is connected to all panels. The main equalizer bus is connected to all generator panels. The auxiliary power bus is connected to the turbo-generator panels and the power panels. Auxiliary equalizer bus is connected to the turbo-generator panels. Emergency 110 volt bus provides 110 volt connection between the 175 kw. generators and panels No. 7 and No. 8 and would be used only in the event that one of the 175 kw. generators would be out of commission during the peak load periods. The auxiliary power bus is provided in order to make possible the isolation of the elevator and heavy 220 volt power load dur-

ing such times when the fluctuating condition of this load might disrupt the voltage regulation of the system. All busbars are supported by substantial brackets and hangers.

The generator rheostats are mounted on an angle iron frame firmly bracketed to the framework of the switchboard.

In back of the main board is placed a fuse and meter board, consisting of three panels of 1½-in. slate identical in size with the switchboard panels. These are in the same alignment with, and 36 ins. to the rear of, panels No. 6, No. 7, and No. 8. The rear of this board is enclosed by a steel cabinet 10 ins. deep, and is provided with doors for each panel. On this board are mounted the fuses and meters for the various feeders. The load of the system has been so distributed that no feeder has a connected load of more than 400 amperes except the 220 volt feeders which are protected with circuit breakers. Instead of metering the output of each generator as had been done previously, each outgoing feeder was provided with a watt-hour meter so that the load distribution may be accurately recorded. The switch and meter boards were manufactured by A. R. Coutts & Company, of Vancouver, B.C.

Distribution of Feeders and Generator Leads

On account of the limited amount of space permissible between the switchboard and the wall, and to accommodate the large number of cables that lead to and from the switchboard, a cable pit, 30 ins. wide and 36 ins. deep, was built the entire length and at the rear of the board, and this was racked off for cable supports. All cables are run underground in conduits. These end in this pit and the cables are carried from the conduit ends to their terminals on porcelain cleats. The pit is floored over with 2-in. cement panels, 24 x 24 ins., supported by an angle iron frame. The intervening space between the floor and switchboard foundation is left open to permit the passage of cables leading to and from the board. Openings are provided in the rear pit wall which extend to the rear of the meter board for the passage of cables in connection with that board. Notwithstanding the fact that but a 30-in. space was permissible behind the switchboard and that the busbars and rheostats would occupy a considerable amount of that space, all details were worked out in such a manner so as to leave an ample and unobstructed space, which permits any part of the board being easily accessible to the operator. As a precautionary measure against trouble at the terminal boards on the generators which are in an unprotected location, they were enclosed in sheet steel boxes.

The main elevator feeders run direct from the switchboard to the distributing board located in the penthouse on the roof, 600 ft. distant.

The 220 volt general power and the 3-wire feeders run to a main distributing board, centrally located on the tunnel floor of the new hotel. This board is laid out in five sections, one for 220 volt power, and the other four for the 3-wire distributing feeders that run to the various panel boards.

Electric Elevators and Dumb-Waiters

The elevators and dumb-waiters are of the Otis-Fensom manufacture and consist of the following: Three passenger elevators of the one to one traction type, having a speed of 500 ft. per minute and operated by 35 h.p. motors running at 63 r.p.m.; one service elevator of the worm geared traction type, operated by a 40 h.p. motor running at 800 r.p.m.; one baggage elevator same as last mentioned; and one kitchen service elevator same as last mentioned, but operated by a 20 h.p. motor. There will be 11 dumb-waiters distributed throughout the hotel, driven by motors varying in size from 3 to 10 h.p. These motors are equipped with Burdette & Roundtree push-button control.

An elaborate system of ventilation has been installed, which continuously supplies pure air tempered to suit the prevailing atmospheric conditions and simultaneously removes impure and obnoxious odors. This ventilating system was supplied and installed by the B. F. Sturtevant Company through their local agent, Mr. Chatham.

The main ventilating fans are located in the basement, fresh air being drawn in from the areaway through enormous Sturtevant air washers, and tempering coils have been distributed throughout the building.

Communicating and Signal Systems

A central telephone exchange connects with every room and department in the hotel and through numerous trunk lines with the main exchange of the telephone company. Extensive telegraphic accommodations have been provided. A telautograph system interconnects all departments. A signal system on every floor indicates the whereabouts of the maids at all times. Fire alarm signals and fire escape indicators are located in the hallways of each floor.

Engineering and Construction

All of the equipment comprising the original power plant of the new hotel, except the 175 kw. units, switchboard, electrical conductors, and refrigerating apparatus, but including all water, steam and exhaust piping, was arranged and installed by Chas. C. Moore & Company, Engineers, San Francisco, California. The engineering and construction details of the revised plant were also conducted by the above company in accordance with the plans drawn up by the architect, Francis S. Swales.

The negotiations attendant to both installations were entered into by H. W. Beecher, the Seattle manager of the above company, with Messrs. Skene & Christie, the general contractors who supervised the construction work. The engineering details attendant to the electrical system were carried out by the author of this article, who supervised its installation.

Personal

Mr. T. A. Hanley has been appointed electrical inspector in Kingston, Ont.

Mr. H. A. Thompson has been appointed electrical inspector over the Belleville and Trenton district.

Mr. H. A. Fyfe has been appointed electrical inspector in Peterborough, with jurisdiction also over Lakefield, Lindsay, and other places to be arranged later.

Mr. R. H. Balfour, for several years assistant superintendent of the Montreal Light, Heat and Power Company, has terminated his connection with the company on his appointment as chief engineer of the Montreal Electrical Commission.

Mr. R. W. Ball, for the last three years manager of the telegraph office of the Canadian Northern Railway Company in Regina, has been appointed to manage the office of the company in Calgary. Mr. Ball is succeeded by Mr. J. D. Edgett, of the Winnipeg office of the company.

Mr. James A. Johnston has been appointed, by the Hydro-electric Power Commission of Ontario, electrical inspector over Brockville, Prescott, Smith's Falls, Merrickville, and several other municipalities in that section. He is a son of Mr. Johnston, chief electrician of the Department of Public Works, Ottawa. His office will be in Brockville.

Mr. C. Ross Cameron, sales manager of the Wm. Hamilton Company, Limited, Peterborough, Ont., recently resigned his position to go to the front as commander of the machine gun battery, 3rd Contingent. Mr. Cameron has been with the Wm. Hamilton Company for about fourteen years, during most of which time he was associated with the 57th Battalion. Mr. G. R. Munro, chief engineer, has assumed the duties of sales manager in addition to those of his own department.

Electric Railways

Women as Street Car Conductors Meeting with Success in England

Optimists on an early closing of the European war point to a shortage of skilled labor in England, which they claim must be greatly accentuated in Germany and Austria, where so many more men are under arms. It would indeed appear that both the field and the industrial armies must be reaching their maximum strength. No doubt the women in all the countries at war are very active in filling the gaps. This is a comparatively new department in England, but a recent issue of the Electrical Review and Tramway World describes some very happy results that have been obtained by different electric tramway companies. The following extract will give us some idea of the extent to which the fair sex are being utilized in this useful form of national defence:—

"For the more successful prosecution of our efforts in contesting the ferocity of the Germans, we, as a nation, need far more men than the number—large as that number is—already enrolled in the Army. The more men who become soldiers the better chance we have of success, and the shorter the duration of the War. The tramways of the country are still employing men of military age, and it is reasonably certain that by one or other means all those who are physically fit—and if they are not they are equally useless to tramways—will be swept into the Army. The country needs every one of them, and if they do not join voluntarily we have no doubt whatever that compulsion will sooner or later be applied. It may not be—and probably will not be—styled "conscription," but for the purposes of this war it will virtually amount to the same thing, by whatever title it may be known. Confronted by this practical certainty, what is the tramway manager to do, or recommend? If there are available a sufficient number of boys, or of men over the military age, he may endeavour to recruit his staff from their ranks. But we all know, as a matter of everyday experience, intelligent boys are very scarce. They have been "moved up" on a large scale during the past six months or so, and even the humble office boy is very difficult to obtain —and keep—because of the demand of youths to fill the positions of the older youths who have joined the colours. The men who are over forty-five years of age are also comparatively scarce, due to the general shortage of labour, and still more owing to the abundance of employment which is on offer at the labour bureaus, and in a general way on all sides. The factories producing munitions or other material for the war clamour for men, and those who are between forty-five and sixty can earn much more money in the factories than the tramways can afford to pay them. Thus, as a last resort, the tramway manager is virtually compelled to take into serious consideration the employment of women as conductors, however much he may be personally opposed to that plan. It is safe to say that the majority of the managers, and probably their committees or directors, do not like the idea. They would much rather not employ women in any traffic work, and they see, or think they see, many objections to the proposal. But they are coming to see that they have little or no choice in the matter, and that the old saw "needs must when the Devil drives" is just about as true as ever it was. The Devil in this instance is the demon of war, and of war on such a scale as the world has never before known. Happily there are consolations in the matter. Mr. Dalrymple was the first British tramway manager to make the experiment with petticoat-power, and it is comforting to learn that his experience, so far, has been quite satisfactory. First of all he tried a couple of ladies who were more or less experienced in the office side of tramway work. They did extremely well, and Mr. Dalrymple felt warranted in extending the number to twelve. These also answered all requirements, and the experience gained was such as to warrant the extension of the idea on a much larger scale, so that at the moment Mr. Dalrymple has the sanction of his committee to employ as many of the women as he needs to fill up the gaps caused by the withdrawal of men for army purposes. During the past month other tramways, Cardiff and Salford for instance, have followed suit, and there is no room to doubt that for the duration of the War we are going to have the female conductor pretty much all over the country. This idea is beginning to get a firm hold on the minds of our managers, and it is not weakened—but rather the contrary—by the agitation of the men on many of the systems for higher rates of pay—an agitation which, in some cases at least, gives one the impression that it is manufactured out of very slight materials, and is carried on with the idea that no matter how much or how little other classes of men may suffer through the war, the tramwaymen must be immune. The woman conductor is available, however. She can do the work, with the sympathy and consideration of the passengers, already plainly shown in the cases where she is employed, and her pluck in stepping forward to fill the breach caused by the rush of men into the Army is entitled to our cordial and grateful recognition."

Railway and Jitney Nickels—Three quarters of the Latter Goes Abroad

"Watts Watt," the publication of the Portland Railway, Light & Power Company, of Portland, Ore., contained a diagram and description of the distribution of the nickel in electric railway and in jitney service. The material was published on opposite pages so as to be more effective. A reproduction, as taken from the Electric Railway Journal, follows:

The Street Car Nickel

(Chart below is based on 1914 operation)
The Part That Stays Here

1.—The street car company does not get a whole nickel. 28 per cent. of it, or 1.4 cents, goes back to the public as a rebate in the form of commutation tickets, free tickets to city employees, such as policemen and firemen, and for transfers, so for each passenger carried the company only gets 3.6

cents. On the other hand, the jitney gets the whole nickel with no reductions of any kind.

II.—Wages alone are 41 per cent. of this 3.6 cents, or more than the entire portion of the jitney nickel left in Portland.

III.—Taxes, bridge rentals and paving expenses consume a big part of the street car fare.

IV.—Then there is the outlay for damages, supervision and other local expenses, all of which stays here; also

V.—The portion of power cost representing wages, wood fuel and local supplies, and

VI.—Depreciation, that part which includes local supplies and local labor.

The Part Spent Elsewhere

I.—Interest on street car investment. Nothing could please the Old Reliable Service Company more than to find Oregon money seeking investment in this company. Invitation to Oregon money has been and is constantly open to such purposes. Oregon money as a rule seeks more profitable investment than that permitted to the public utilities. And, so, the Eastern investor who is content with more modest interest return, comes to Portland's aid and that of the surrounding community by furnishing nearly all the funds required by the Old Reliable Service Company and other similar public utilities.

II.—Material manufactured elsewhere takes a small portion of the nickel.

III.—Remaining items entering into power cost.

IV.—Depreciation, that part which includes those things which cannot be purchased or made here.

¾ OF THIS NICKEL IS REINVESTED IN PORTLAND

The Jitney Nickel

(Chart below is based on best available data from several sources here and elsewhere)

The Part That Stays Here

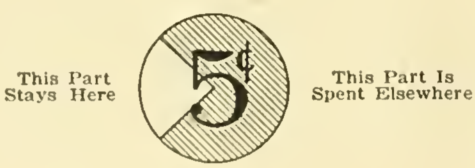
I.—Garage expenses and such repairs as can be made locally.

II.—Interest (if venture is not financed by automobile company or other outside interests).

III.—License fees.

IV.—Damages (in case victims succeed in recovering anything).

V.—Wages, when anything is left after other necessary expenses are paid. The fact that there are 35 per cent. fewer jitneys in operation now than sixty days ago is evidence that the wages earned by the jitney operators are not sufficient to make the business attractive in by far the majority of cases. The City Hall Records prove this. Very few of the original jitney drivers are in business to-day. The fact that new ones have taken their place simply proves P. T. Barnum's famous statement.



The Part Spent Elsewhere

I.—Little Johnnie Rockefeller gets a big slice of the nickel for gasoline and oil.

II.—The Rubber Barons come in for another fat part of the coin (there are no tire factories in this locality).

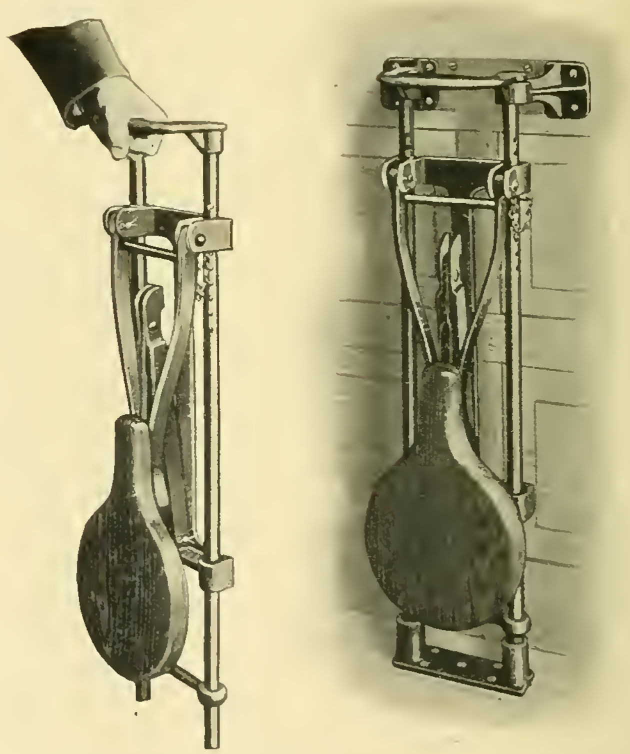
III.—Repair parts bought from the Eastern auto manufacturers absorb a little more.

IV.—Depreciation. This is one of the rocks on which the big bulk of the jitney wild-catters have gone broke. Usually, old second-hand machines are purchased on the installment plan and are operated until they are in the last stages of "consumption," and then they are "scrapped" and sent to the "Old Ford's Home" and the jitney man must buy another or go out of business.

ONLY ¼ OF THIS NICKEL STAYS IN PORTLAND.

Keystone Motorman's Seats

A new removable type of Keystone motorman's seat is being manufactured by the Electric Service Supplies Company, Philadelphia, which allows the seat proper to be transferred from one end of the car to the other. In this new type all of the quick collapsible and adjustable features of the standard Keystone seat are retained, as will be noted in the illustrations. One pair of brackets for supporting the upper end of standards and one floor plate for securing lower end are the only stationary parts, and it is from these that the seat is readily removable. Special upper brackets are furnished to take care of the curvature of the inside of the dash or to overcome other existing obstructions.



Removable type of motorman's seat.

New Books

Resuscitation—From electric shock, traumatic shock, drowning, asphyxiation from any cause; by means of artificial respiration by the prone pressure Schaefer method; anatomical details of the method and complete directions for self-instruction; by Chas. A. Lauffer, A.M., M.D., medical director, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.; second edition, enlarged; John Wiley & Sons, Inc., publishers.

The Dealer and Contractor

The Proper Installation of Wiring and Lighting —Some Valuable Illustrations and Data for the Electrical Contractor

The other man's point of view regarding the proper method of installing lighting units and the wiring to serve these units is always valuable, especially if the opinion comes from one who has had experience. In a recent issue of Power, Mr. A. L. Cook, head of the Department of Applied Electricity, Pratt Institute, Brooklyn, N.Y., discusses interior wiring for lighting and power service, and a number of extracts from this very valuable paper are printed herewith.

The allowable watts per square foot for a given class of work can be found from Table 1, and when multiplied by the floor area, will give the total power required. It may seem to some that the height of the lamp above the work would have a decided effect upon the amount of power required, but this is not the case provided a suitable reflector and proper spacing of the lamps are employed. There is, however, a considerable difference in lighting depending upon the number of units employed and the color of the walls and ceiling.

Table 1—Power Required for Illumination. Tungsten Lamps*

Class of Work	Watts per square foot Direct A	Indirect B
Office—general	1.00	1.60
Office—special	1.25	2.00
Drafting room	2.00	3.20
Corridors and halls	0.50	0.80
Factories—general	0.80	....
Factories—special	1.50	....
Warehouses	0.50	....
Stores	1.25	2.00
Power house	0.80	....
Storage	0.30	....

*If nitrogen-filled lamps are used, multiply the watts per square foot as given above by 0.75.

As an example, the figures of Table 1 will be applied to the lighting of four floors of a factory building having a width of 46 ft. and a length of 135 ft., divided into nine bays 15 ft. wide, with a line of columns down the centre of the building. Table 2 gives a tabulation showing the lighting to be provided for each floor.

Table 2—Example of Lighting Calculation

Floor	Character of Work	Ceiling Hight, Feet	Area, Sq. Ft.	Assumed Watts per Sq. Ft.	Size of Unit	Actual Watts per Sq. Ft.
Basement	—Storage	8	6210	0.30	60	0.35
First floor	—Machine Shop	14	6210	1.50	100	1.74
Second floor	—Assembly	12	6210	1.50	100	1.74
Third floor	—Stock room	12	6210	0.50	100	0.58

This building would employ direct lighting by means of tungsten lamps, and steel or glass reflectors. From the given floor areas and the allowable watts per square foot, the approximate amount of power can be estimated. This would be sufficient for an estimate of the total load required for the lighting, but in general it is best to choose the size of units and determine the number to be employed, since the spacing which must be used often modifies the total load.

The spacing and size of unit to be used are affected by the height of ceiling as well as by the arrangement of the beams or girders. There is a certain relation between the height of the lamps and their size, which must be adhered to as closely as possible, in order to get uniform illumination without objectionable shadows. For low ceilings the units should be small and closely spaced, while for high ceilings large units, more widely spaced, should be used. Table 3 will serve as a guide to the selection of the proper size of unit. This should be used in connection with Table 4 which gives the approximate spacing of lamps of different sizes.

The units should be mounted at least 8 ft. from the floor and more if possible, a height of 10 ft. being satisfactory for rooms with ceilings 11 to 16 ft. high. For higher ceilings, cranes and other obstructions usually fix the height of mounting. If deep girders divide the ceilings into bays, the lamps should be located slightly below the bottom edge of the girders if possible. Having fixed upon a suitable mounting height, a size of unit should be chosen by reference to Table 3.

Table 3—Sizes of Lighting Units for Various Mounting Heights

Height of Unit above Floor	Size of Unit, Watts
Up to 9 ft.	40 or 60
9 to 11 ft.	60 or 100
11 to 16 ft.	100 or 150
16 to 20 ft.	150 or 250
20 ft. and above	250, 400, 500 and nitrogen-filled lamps or flames arcs

The rating of this unit divided into the total watts for the given floor area will give the required number of lights. This number should then be laid out upon a plan of the room and the spacing checked with the average values given in Table 4.

The lamps should be located without reference to the individual machines, so that a change in the latter would not affect the system. Each light should, if possible, be located in the centre of a square, Fig. 1, the length of the side being the spacing distance assumed. The lamps should be arranged in parallel rows, the distance between rows each way being as nearly as possible equal to the given spacing distance. The distance from the wall to the first row should be about one-half the spacing distance, except where benches are located at the side walls, when the first row of lights should be located about 12 to 18 ins. nearer the wall than the edge of the bench. If the room is divided into bays by deep girders or columns, each bay should be treated as far as possible as a unit, and the lights so spaced as to avoid shadows from the columns. If the size of lamp first selected does not give a suitable number for convenient location, a different size should be chosen and another arrangement tried. It is, of course, desirable to use as large a unit as possible, to reduce

the cost of the wiring; on the other hand, a smaller unit gives more uniform distribution of the light, greater freedom from shadows, and less trouble due to one light being extinguished. With a smaller unit it is also possible to arrange a more flexible method of control, allowing some of the lamps to be extinguished during a part of the time, and resulting in a saving in power.

Table 4—Approximate Spacing Distances for Lighting Units

Size of Units, Watts	Watts per Sq. Ft. Direct*	Spacing Distance	Size of Units Watts	Watts per Sq. Ft. Direct*	Spacing Distance
40	0.3	11 ft. 6 in.	150	1.5	10 ft.
40	0.5	9 ft.	150	2.0	8 ft. 8 in.
40	0.8	7 ft.			
			250	0.3	29 ft.
60	0.3	14 ft. 2 in.	250	0.5	22 ft. 5 in.
60	0.5	11 ft.	250	0.8	17 ft. 8 in.
60	0.8	8 ft. 8 in.	250	1.0	15 ft. 10 in.
60	1.0	7 ft. 9 in.	250	1.25	14 ft. 1 in.
60	1.25	7 ft.	250	1.5	12 ft. 11 in.
60	1.5	6 ft. 4 in.	250	2.0	11 ft. 2 in.
100	0.5	14 ft.	400	0.8	22 ft. 5 in.
100	0.8	11 ft. 2 in.	400	1.0	20 ft.
100	1.0	10 ft.	400	1.25	17 ft. 11 in.
100	1.25	9 ft.	400	1.50	16 ft. 4 in.
100	1.5	8 ft. 2 in.	400	2.0	14 ft. 1 in.
100	2.0	7 ft.			
			500	0.8	25 ft.
150	0.5	17 ft. 4 in.	500	1.0	22 ft. 5 in.
150	0.8	13 ft. 8 in.	500	1.25	20 ft.
150	1 0	12 ft. 3 in.	500	1.50	18 ft. 3 in.
150	1.25	11 ft.	500	2.0	15 ft. 10 in.

*The figures given apply to ordinary tungsten lamps. In general the spacing of lamps should be about 50 per cent. greater than their height above the work illuminated.

In the example selected, the basement requires about 0.3 watt per square foot. From Table 3 either 40 or 60-watt

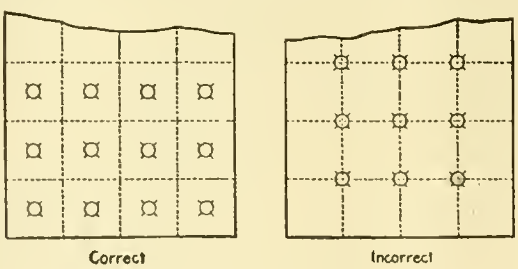


Fig. 1.

lamps could be used. From Table 4 it will be seen that 40-watt lamps, to give 0.3 watt per square foot, must be spaced on 11 ft. 6 in. centres. This does not work in well, since the bays are 15 ft. wide. If 60-watt lamps are selected the spacing could be 14 ft. 2 in., which would allow one lamp in each row per bay. Allowing four rows—two either side of the line of columns—gives a total of 36 lamps or 36 × 60 = 2,160 watts, which gives $\frac{2160}{6210} = 0.35$ watt per square foot.

The spacing of the rows would be $\frac{46}{4} = 11$ ft. 6 ins., the two rows next the walls being 5 ft. 9 ins. from the wall.

For the first floor about 1.5 watts per square foot will be required. From Table 4 it will be seen that a 100-watt unit would give a spacing of 8 ft. 2 ins., and from Table 3 that this size is suitable for the height of ceiling. Therefore, two units per bay can be allowed, giving a spacing of 7 ft. 6 ins. With six rows there would be a total of 108 units, requiring 10,800 watts. This is equivalent to 1.74 watts per square foot, which is somewhat more than was assumed. If the same number of 60-watt units were selected, a total of 6,480 watts would be required, or 1.04 watts per square foot. Because of the columns through the centre seven rows could not be used and with eight rows the spacing would be too small and the cost installation too great. The distance between the wall and the first row would ordinarily be one-half the distance between the other rows; but in this case, as there would be benches along the walls, the rows next the walls

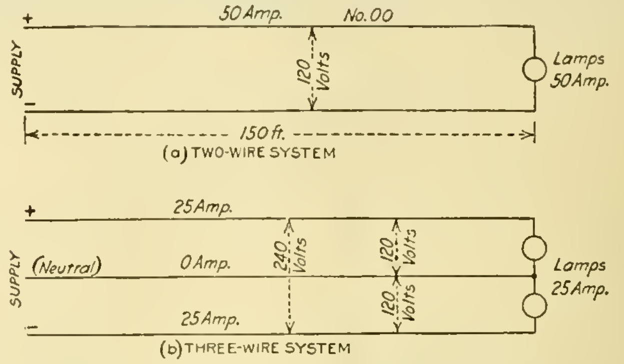


Fig. 2—Two and three wire systems.

could be located 2 ft. away, and the other rows spaced evenly, giving about 8 ft. 5 ins. for the distance between these rows. The other floors would be treated similarly. If there are no beams to divide the room into bays, the problem is simplified, but it must be remembered that the lamps should be located in the centre of the square or rectangle and not at the corners.

When the size and location of the units have been settled the branch circuits can be arranged. The "National Electric Code" specifies that a branch circuit which is dependent upon a cut-out shall not carry more than 660 watts or have more than 16 sockets and receptacles, except by special permission in cases where No. 14 wire can be carried directly into keyless sockets. Under these conditions, 1,320 watts and 32 sockets may be used. The arrangement of these branch circuits should be such that the lamps on one branch

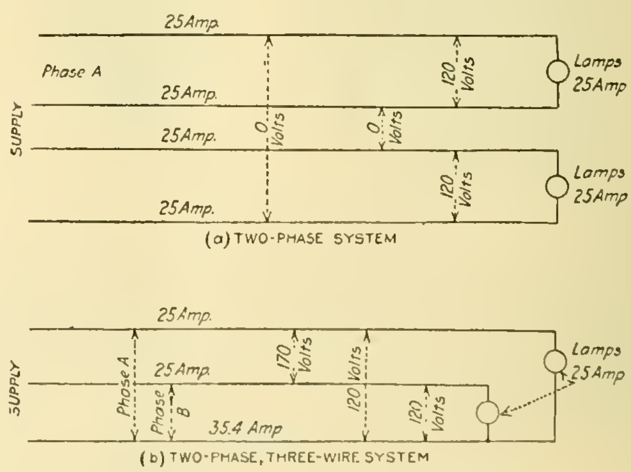


Fig. 3—Current and voltage relations in 3-phase system.

are grouped as closely as possible. The lamps near the windows should be controlled separately. It is also best to so plan the branch circuits that the wires will not have to cross heavy beams or girders. Details regarding various arrangements of branch circuits will be taken up later.

Incandescent lamps are so sensitive to changes of voltage that it is necessary to maintain a steady and as nearly as possible constant voltage on them, irrespective of the load on the system. The tungsten lamp, however, is not as sensi-

tive as a carbon lamp; for a difference of 1 per cent. in voltage the 12-volt tungsten lamp changes 3.6 per cent. in candlepower, while for a carbon lamp the change is 5.6 per cent. Because of this effect, lighting circuits should not be supplied from motor circuits, but should be run independently. The voltage drop in a lighting system carrying full load should not be supplied from motor circuits, but should be run independently. The voltage drop in a lighting system carrying full load should not exceed the following: Branches, 1.5 per cent.; mains, 0.7; feeders 1.3; total, 3.5 per cent. When there are no mains, the drop allowed for the mains is included in the feeder drop.

Lamps used for indoor lighting should always be operated in multiple, as a series system with arc or incandescent

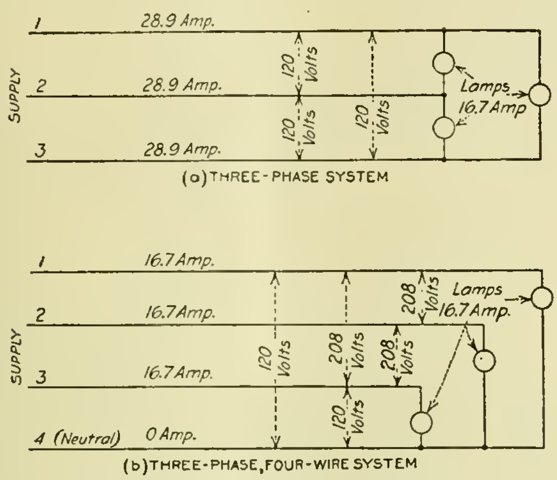


Fig. 4.—Current and Voltage Relations in 2-phase System.

lamps is not desirable, because of the high voltage necessary and lack of flexibility. Even the operation of 120 or 240-volt lamps in series on a 550-volt system is not good practice except in special cases, such as railway power houses or car barns. Because of the limitations of the incandescent lamp the lighting system must employ about 120 or 240 volts, the former being preferable.

The systems of distribution include two-wire and three-wire circuits, either direct or alternating current, and three-phase or two-phase. The branch circuits are generally two-wire and will be so considered in the present discussion. The feeders and mains, however, may be arranged on any of the systems mentioned. The two-wire is the simplest, but the voltage is limited to that of the lamps, which cannot exceed 240. When it is remembered that by doubling the voltage, only one-fourth as much copper is required for a given percentage drop, the advantage of using as high a voltage as possible is apparent. On the other hand, the use of 240 volts on lamp circuits increases the cost of maintenance, and the efficiency of the lamps is lower, so that 120 volts is more satisfactory. By means of the three-wire system, with 120 volts between each outside wire and the neutral and 240 between the outside wires, 120-volt lamps may be used; but the power will be transmitted at 240 volts and the copper required will be three-eighths that required for a two-wire 120-volt system. The amount of copper would, of course, be greater than if a 240-volt two-wire system were used, as this would take one-quarter of that necessary for a 120-volt two-wire system. The advantages in the use of 120-volt lamps will, however, generally justify the extra cost of the three-wire system. Fig. 2 represents a two-wire and a three-wire feeder system carrying a load of 50 amp. at 120 volts. One-half of the lamps would be connected across each side of the three-wire circuit.

The three-phase system is sometimes used for lighting, three wires being used, with the same voltage between any two; see Fig. 3. The lamps are divided equally between the three phases. Sometimes a fourth wire, called a neutral, is provided, as shown at b. In the arrangement shown at a, the copper required is three-fourths that for the two-wire system shown in Fig. 2-a, and in the four-wire, three-phase system the copper is one-third that necessary for the two-wire.

The two-phase system is illustrated in Fig. 4. The lamps are distributed equally across the two phases, and it will be seen that the arrangement is the same as two single-phase circuits. There is no electrical connection between the two phases, and consequently no voltage between them. The copper required is the same as for the two-wire system in Fig. 2-a. Frequently, two of the wires are combined, as shown at b. The copper required for this arrangement is 0.73 times that for the two-wire system.

Conduits

In the majority of installations rigid, unlined iron conduit is desirable, although the first cost is greater than where the wires are run exposed. The greater freedom from damage to the circuits and the improvement in the appearance of the wiring will generally justify its use. In factory wiring, it is sometimes better to run the feeders exposed, using iron conduits for the mains and branches, particularly in an extensive plant where the feeders can be so located that they are not likely to suffer damage. The conduits must be large enough to allow the wires to be pulled in after the conduits are in place without damaging the insulation. The size depends, therefore, upon the number of bends. The "Code" requires that the maximum number of bends shall not exceed the equivalent of four right angle bends, and if more are necessary a pull-box must be inserted in the run so that the wire may be pulled in sections. It is desirable to make the radius of the bends as great as is consistent with other limitations. The stock bends, which can be purchased from the conduit manufacturers, can be used, except in special cases, where a longer radius bend is desirable. The ordinary iron conduit consists of soft-steel pipe made in standard weight iron pipe sizes and threaded the same. It has a heavy, smooth coating of enamel on the inside to facilitate pulling in the wire and is either enamelled or galvanized on the outside. The galvanized conduit is more desirable where it is to be painted after installation, and it can also be more easily grounded as required by the "Code."

In Table 5 are given conduit sizes for various sizes of

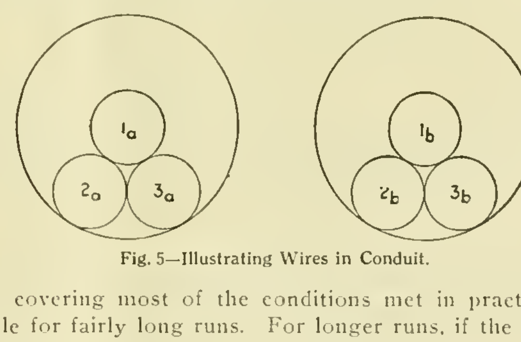


Fig. 5—Illustrating Wires in Conduit.

wires, covering most of the conditions met in practice and suitable for fairly long runs. For longer runs, if the number of bends is decreased, the same sizes may be used; for shorter runs, the size may in some cases be reduced.

An approximate rule is to choose such a size that the wires will just be contained inside a circle three-quarters the outside diameter of the conduit. For alternating current work all the wires of a circuit must be contained in the same conduit. This is required by the "Code," because if run in separate iron conduits there would be excessive heating of the conduits and a greatly increased drop due to the alternating magnetic field produced by the current flowing in the

wire. This effect will be greater the larger the current, but even for the smallest wires the rule should be followed. If the conduits are of brass, fibre or tile, the wires can be safely separated in different ones, but even then the drop is so great that it is generally better to combine the circuit in one conduit. If the current is so great as to require more than one wire for each lead of the circuit, and it is not feasible to put them all in one conduit, the leads should be divided into two or more groups, each containing all the poles of the circuit. The proper arrangement for a three-phase circuit is shown in Fig. 5, where the leads of the three phases are 1, 2, and 3 respectively, 1-a and 1-b being of the same polarity. This rule applies for all types of alternating current systems except the two-phase four-wire, which is practically the same as two single-phase circuits, and phases A and B may be run in separate conduits. For direct-current circuits it is satisfactory to employ separate conduits for each wire, if of large size, unless there is probability of a change being made to alternating current.

Table 5—Sizes of Unlined Iron Conduit for 600 volt N. E. C. Standard Rubber Wires

	Number of Wires in One Conduit			
Size of Wire	One	Two	Three	Four
14*	½ in.	½ in.	¾ in.	¾ in.
12*	½ in.	¾ in.	¾ in.	¾ in.
10*	½ in.	¾ in.	1 in.	1 in.
8	½ in.	1 in.	1 in.	1 in.
6	¾ in.	1 in.	1¼ in.	1¼ in.
5	¾ in	1¼ in.	1¼ in.	1¼ in.
4	¾ in.	1¼ in.	1¼ in.	1½ in.
3	¾ in.	1¼ in.	1¼ in.	1½ in.
2	¾ in.	1½ in.	1½ in.	2 in.
1	¾ in.	1½ in.	2 in.	2 in.
0	1 in.	2 in.	2 in.	2 in.
00	1 in.	2 in.	2 in.	2½ in.
000	1¼ in.	2 in.	2½ in.	2½ in.
0000	1¼ in.	2 in.	2½ in.	2½ in.
300,000	1½ in.	2½ in.	3 in.	3 in.
400,000	1½ in.	3 in.	3½ in.	3½ in.
500,000	2 in.	3 in.	3½ in.	3½ in.
600,000	2 in.	3½ in.	4 in.	......
700,000	2 in.	3½ in.	4 in.	......
800,000	2 in.	3½ in.	4 in.	......
900,000	2½ in.	4 in.	4½ in.	......
1,000,000	2½ in.	4 in.	4½ in.	......
1,250,000	2½ in.	......	......	......
1,500,000	3 in.	......	......	......
1,750,000	3 in.	......	......	......
2,000,000	3 in.	......	......	......
14 duplex*	......	½ in.	......	......
12 duplex*	......	½ in.	......	......
10 duplex*	......	¾ in.	......	......

Based on runs not over 100 ft. long and not over four standard bends.

*These sizes are solid; all other sizes are stranded.

New Contractors' Association Doing Energetic and Effective Work

The new Electrical Dealers and Contractors' Association of the city of Toronto, which is a sub-section of the Retail Merchants' Association of Canada is off to a good start. During the last two or three weeks the various Toronto dealers and contractors have received a number of forceful letters, pointing out the progress made by the association and the possibilities which may result from their organization, if the members will lend their support and co-operation. The meetings, which are held weekly, are getting larger and more interesting, and discussions carried on are calculated to improve the status of the contractor and place the electrical business on a higher plane.

As an example of these letters, we may mention that sent out by Mr. Geo. T. Dale, chairman of the re-sale committee of the Association. This has reference to the relationship which does and should exist between supply dealers and contractors, especially regarding the question of dealers selling goods to the contractors' customers. Certain information of a statistical nature is being sought, and it is hoped an arrangement can be arrived at, with the dealers, of a nature satisfactory to both.

Another letter by Mr. A. Wales, chairman of the organization committee,. urges the necessity of every contractor becoming a booster—getting behind his section and pushing. Every contractor is urged to communicate with Mr. Wales the name of any friend or acquaintance who is not already a member.

Mr. G. D. Earle, chairman of the inspection and rules committee, has sent out enquiries regarding the effect of the present rules on the business of the different contractors. This is an important question, inasmuch as changes in rules and regulations without proper notice always tend to leave the contractor with a quantity of old material on his hands. This committee will endeavor to see to it that, in future, the proper notice is demanded and given.

One of the most troublesome stumbling blocks in the path of the dealer and contractor in a very large number of our cities and towns is the competition between himself and the central station or the municipality in the sale of supplies, wiring of buildings, and so on. Municipalities and companies alike have argued that they were driven to it because the contractor did not follow this business up with sufficient vigor. However, with a properly organized association, composed of live members, this competition should disappear, and we have no doubt that the central station or the municipality, as the case may be, will be amenable to reason. The new Toronto association will tackle this problem anyway, and we wish them success. Mr. S. Windeler is the chairman of the power company committee.

Still another letter, signed by the president, has been sent out, having special reference to the operation of the Workmen's Compensation Act. The opinions of the various contractors on the justice of the present rating is asked.

Exclusive Canadian Agents

The Federal Sign System (Electric) of Toronto, and the Flexlume Sign Company, Limited, of St. Catharines, announce that an agreement has been entered into whereby the Federal Sign System (Electric) has become the exclusive sales agents for the Flexlume signs in the Dominion of Canada. The Federal Sign System (Electric) will continue to sell the famous Sectional Letter Signs and all types and kinds of special design signs in addition to the Flexlume line. Mr. J. G. Arnold will represent the Federal Company as Canadian Sales Manager, the office of the Federal Company being located at 240 King Street East, Toronto.

Cost of Electrical Cooking

The Toronto Electric Light Company, in the May issue of their Electric Service Magazine, reproduces the bill for electric cooking for the month of March 4th to April 5th in an eight-room house, occupied by six people. The total consumption is 185 kw. which, at the current rates of this company, amounts to $3.93. This is an old customer who has been on the line using the same range for some time. The consumption from November 3rd to December 3rd, 1914, is also given and amounts to 184 kw.

Central Station Fan Campaign

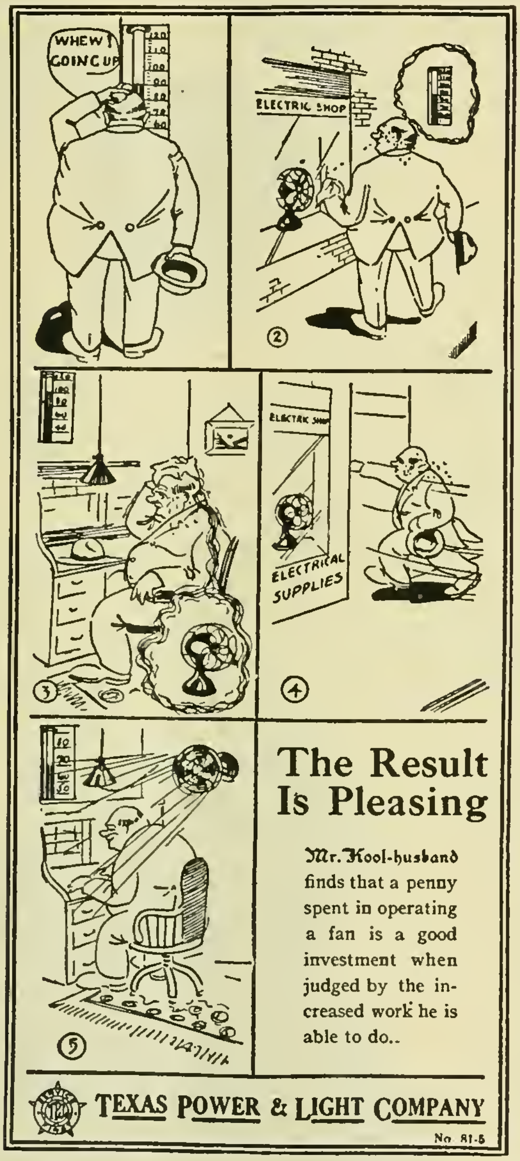
The Texas Power & Light Company this year conducted a special fan campaign in all of the cities in which it operates, in co-operation with electrical contractors and dealers. To every electric consumer in the towns in question a little sheet was sent. This called attention to a series of advertisements which were placed in the daily papers.

The plan of the whole campaign was to feature Mr. "Kool-Husband" and Mrs. "Kool-Wife" two fictitious characters. The campaign started by showing Mr. Kool-Husband looking at a thermometer and feeling the need of a fan. The second piece of advertising included the first cartoon and in addition showed Mr. Kool-Husband passing in front of an electric shop where he saw some fans. The third piece of copy included the first two cartoons and in addition a third showing Mr. Kool-Husband sweltering in his office. The next showed him going into an electrical shop and purchasing an electric fan. He was next shown in his office enjoying the refreshing breezes. The series was continued by bringing his wife into the limelight, showing her in a hot kitchen and afterwards in her husband's office, in the electric shop and in her sitting room. The successive pieces of copy are shown in the accompanying figure. The most important part of the campaign was the fact that each advertisement contained cartoons of all the advertisements previously used, thus building up the interest and inducing people to watch for the series.

An announcement of the plans was sent to each electrical contractor and dealer in each of the towns and it was pointed out that to get full benefit from the advertising it would be to their advantage to carry local advertising of their own, asking the newspapers to run their copy on the same pages as that of the central station copy.

The offer was also made to contractors to supply suggestions for fan copy to be used in these local advertisements. This service was rendered without charge. It was also suggested that the advertising be supplemented by an appropriate fan window display and where possible to make the display a moving one. For instance, instead of a stationary fan in the window it is better to use one with ribbons fluttering, as this secures much more attention from the passing public.

The final element in the campaign was the sending out each week of bulletins in the shape of a telegram and bearing a heading "New Business Co-Operative Letter-Gram," accompanied by a zig-zag lightning stroke. These bulletins gave figures for the number of fans connected in the various towns for each week.

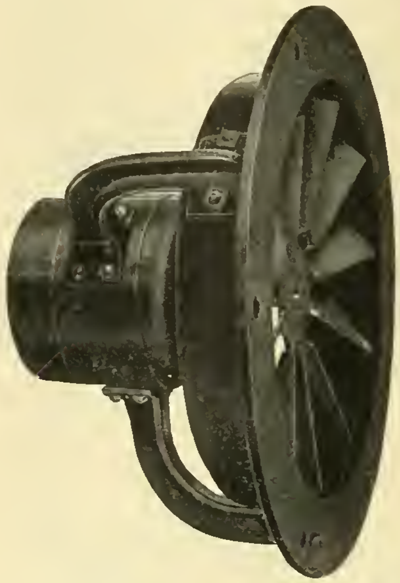


Two typical advertisements in which the central station co-operated with the contractor.

What is New in Electrical Equipment

Operates either as blower or fan

The fan illustrated hereunder has recently been developed by The Vacuum Car Ventilating Company, Chicago, Ill., and can be furnished to operate either as a blower or an exhaust fan. Thrust bearings are provided to permit of vertical or horizontal operation. The fan is stamped from a single sheet of brass and has ten blades. It is riveted to a turned brass hub. At the operating speed the fan has a capacity of 800 to 900 cubic feet per minute, while under service conditions with restricted inlet the capacity will be in excess of 500 cu. ft. The motor is a fully enclosed type supplied by The Robbins & Myers Company, Springfield, Ohio, and operates at 1,750 r.p.m. The outfits are regularly furnished for operation on 85, 110 or 220 volts direct current, and 110 or 220 volts alternating current.



New type bell-ringing transformer

A new type of bell-ringing transformer, manufactured by the Jefferson Electric Manufacturing Company, 847-51 West Harrison Street, Chicago, is shown in the accompanying illustration. One of the chief objections to the use of the bell-ringing transformer is the poor design of certain makes, which render them a source of continual trouble on the line. This company claim that their transformer is at the same time one of the most efficient and one of the safest pieces of apparatus of this kind yet devised.

Lincoln Electric Company in new offices

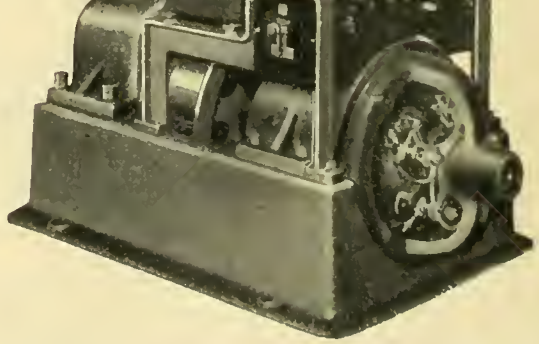
The Lincoln Electric Company of Canada announce that they have removed their offices from 202 Lumsden Building, Toronto, to rooms 311-12 Kent Building, corner Yonge and Richmond Streets.

A Two-Cell Hand Lamp

The Metal Specialties Manufacturing Company, Chicago, are now manufacturing a two-cell hand lamp, shown herewith, which is equipped with two No. 6 cells, a 3-volt lamp, and a 3-inch bull's-eye lens. This is an extension of the principle of single cell lamps which have been placed on the market in recent months in such great variety, and represents an improvement on account of the greater candle power obtainable. The weakness of the single cell lamp, if it has a weakness, is its limited candle power. The two-cell device will give either twice the illumination or the same illumination for twice as long. This lantern is 7 inches high by 6 inches wide, put up in an attractive black enamelled case and supplied with an ordinary wire lantern handle. The reflector is pivoted so that it may be moved to any angle and the light concentrated where most needed.

Light and Power for the Country Home

For the farm, store, club or country home, electric light and power is now available through many different designs of small isolated plants that have recently been placed on the market. One of the most recent is illustrated herewith, as manufactured by the L. B. Jones Company, Kansas City, Mo. This set is complete and compact on one 22-inch by 32-inch base with a capacity of 30 electric lights of 20 candle-power each. The engine is a three-inch bore, 4½-inch stroke, 4 cycle, water cooled type, using gasoline. The generator has a capacity of 750 watts and supplies current at 32 volts. The system also includes a storage battery set, which will carry the lighting load during the night or when only a small number of lamps is required. This plant is automatically



controlled in every way—it starts, runs, oils, regulates and stops itself without any manual interference. With gasoline at 15 cents and lubricating oil at 40 cents, the company guarantee the cost of production less than 3 cents per kw.h.

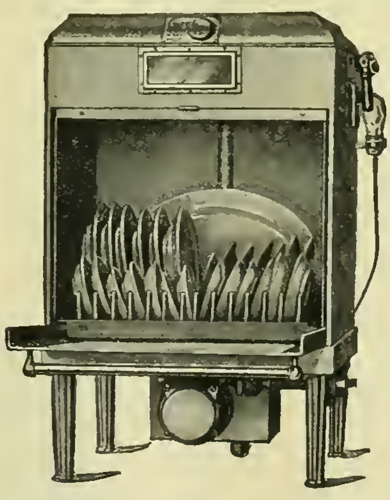
"Uno" Shade Holders

The three illustrations herewith represent new equipment just placed on the market by the Arrow Electric Company, Hartford, Connecticut. Two of these are "Uno" shade holders, No. 501, with screws, and No. 502, with a wire spring. The third represents a pull socket with threaded

bead for "Uno" shade holders. The manufacturers claim that the thread on the bead, permitting the use of a one-piece "Uno" shade holder, makes the most permanently rigid, the most sightly, the most economical and the most rapidly attached combination of shade holder and shell yet devised.

A Household Electric Dish-washer

A promising looking household electric dish washer, the "Crescent," is being marketed by the Bromley-Marseles Manufacturing Company, 217 West Superior Street, Chicago. This washer is illustrated herewith. The dishes are stacked in this machine on wooden racks, a separate space being provided for each piece, which is so placed as to be exposed to the hot spray which is thrown up into the dish washer. All other parts of the machine are made of metal. The water is sprayed over the dishes from above and is caught in a tank

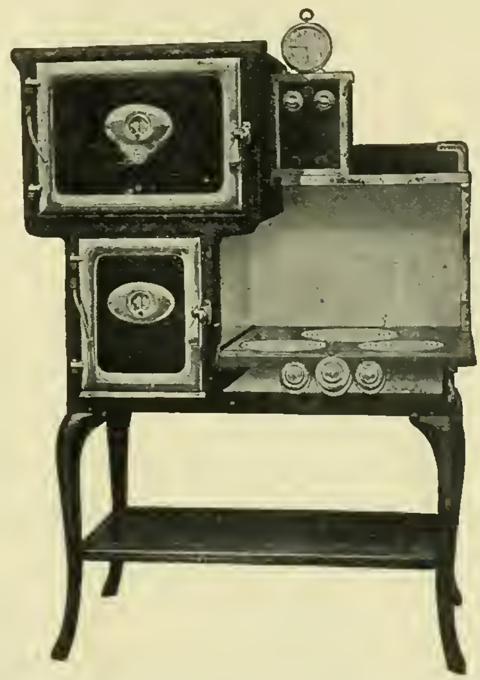


at the bottom and drained off to the sewer. The actual operation of washing the dishes takes but a few minutes. After this, rinsing hot water is passed in and forced over the dishes. When the rinsing water is drained off, the dishes dry very rapidly and are taken from the machine dry. Thus, they do not have to be touched by dish cloth or drying cloth during the complete operation. This washer occupies about 2 feet square of floor space and, being finished in white enamel with nickel trimmings, may be considered an ornament in any kitchen.

The St. John Railway Company opened their extension to Coldbrook on May 24th.

Electric Ranges

"Ready by the clock" is the slogan adopted by the Westinghouse Electric & Manufacturing Company for its new line of electric ranges, signifying that meals can be cooked on these ranges to be ready at a certain time. The ovens of these ranges have automatic temperature and time control. The thermometers in the oven doors can be set for the desired temperature and the clock switch set for the time it is desired to begin cooking. At the time set the circuit is closed and the ovens begin to heat. As each oven reaches the desired temperature the current is automatically turned off and the range continues to cook as a fireless cooker. The heat storage principle used in the ovens makes them unusually economical in the consumption of current and also fixes the middle of the peak load caused by the ranges from an hour to an hour and a half earlier than it would be if the current were used continuously. By means of the automatic control, it is possible for the housewife to leave the range to itself after the food is prepared, and go calling or shop-



ping with the assurance that the meal will be properly cooked and hot at the desired time and with a minimum consumption of current. This arrangement also makes it possible to prepare breakfast before retiring at night and have hot, deliciously prepared cereals and coffee ready at breakfast time. All heaters used in these ranges are of the radiant type with replaceable heating elements. The heating elements are inexpensive and can be replaced in a few minutes with a screwdriver and pliers. In the stove type heaters, the heating elements are laid in deep grooves in a moulded porcelain compound that does not chip or crack under extreme heat and is impervious to water, acids and alkalies.

The total wattage for the large size range is 5,850, divided as follows: large oven, 1,500 watts; small oven, 850 watts; 10-in. heater, 1,500 watts; each 8-in. heater, 1,000 watts. As the small size range has no small oven, its total connected load is 5,000 watts. Of this total load, however, more than 3,500 watts is seldom used at any one time, and this only for a very short time, as it requires only 32 minutes to bring the large oven to baking heat, and considerably less time to secure boiling heat.

A record obtained from 24 families over a period of six months shows an average consumption of about 100 kw. hours per month. The accompanying table shows the consumption over the six months' period:—

Electrical Consumption in Kw. Hours

Consumer	Jun	July	Aug	Sept	Oct	Nov	Total	Average per mo
1	174	10	10	119	32	197	542	90
2	100	108	95	87	107	100	597	99
3	88	105	77	88	85	100	543	90
4	100	91	100	100	99	100	590	98
5	...	114	106	138	143	175	676	135
6	82	100	105	100	159	126	672	112
7	184	78	97	100	96	100	655	109
8	60	71	82	89	74	113	489	82
9	97	97	100	97	74	100	565	94
10	...	...	...	...	43	91	134	67
11	102	96	96	77	85	98	554	92
12	...	...	...	...	...	91	91	91
13	129	125	122	126	129	144	775	129
14	95	91	100	97	73	75	531	89
15	128	95	118	98	101	107	647	108
16	96	89	100	97	93	105	580	97
17	...	100	141	179	155	170	745	149
18	114	128	104	35	100	49	530	88
19	100	100	98	77	86	97	558	93
20	72	83	77	104	53	138	527	88
21	100	100	70	71	82	98	521	87
22	98	93	100	62	58	...	411	82
23	64	101	...	...	...	...	165	83
24	...	...	...	...	...	68	68	68

Total—24 consumers 1 month 2,320
Average consumer per month 97

New Oshkosh Catalogue

The Oshkosh Manufacturing Company, of Oshkosh, Wis., are issuing a new catalogue. This will be a most complete catalogue of strictly outside electrical construction tools and can be furnished either bound or in loose-leaf form. In sheet form the size conforms to the Electrical Supply Jobbers' Association "Red Book." Bound copies or sets of sheets will be supplied direct by the company or may be had through any of their representatives.

Mr. F. E. Getts is General Manager

The Electrical Engineers' Equipment Company, 711-15 Meridian Street, Chicago, announce the appointment of Mr. Frank E. Getts as general manager of the company on and after May 1st, 1915. Mr. Getts was formerly district sales manager of the Alberger Pump & Condenser Company, Chicago.

Trade Publications

Starting Rheostats—Bulletin 48,303, issued by the Supply Department of the Canadian General Electric Company, Toronto, illustrating and describing hand operated starting rheostats and panels for direct current motors.

Lightning Arrester—The Delta-Star Electric Company, Chicago, are distributing a new folder, No. 49, describing their automatic high speed sphere gap S. & C. arrester. The valve action of this arrester is well demonstrated, and will be of interest to those interested in high tension transmission.

Automatic Starters—Bulletin No. 48,405, by the Canadian General Electric Company, illustrating and describing automatic starters for a.c. motors.

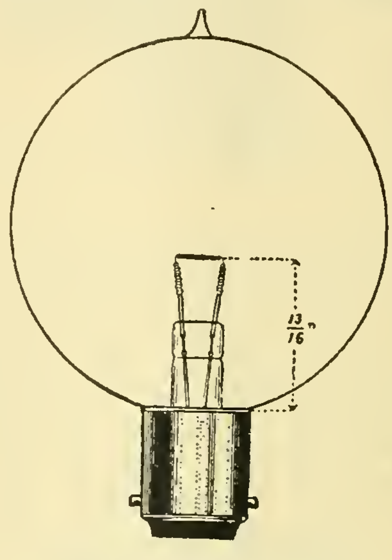
Catalogue No. 150—Issued by the Moloney Electric Company of Canada, Limited, Windsor, Ontario, illustrating and describing Moloney high and low tension transformers.

Fibre Conduit—Illustrated pamphlet issued by the American Conduit Company, entitled "Methods of Manufacturing Fibre Conduit." Copies of this pamphlet may be obtained from the branch houses of the Northern Electric Company, who are the Canadian distributors.

Outdoor Sub-Stations—The Delta-Star Electric Company, Chicago, are distributing descriptive leaflet No. 720, showing ten typical outdoor high tension steel tower substation installations. The illustrations are made from actual photographs taken in the field, and will be of interest to central station managers contemplating this type of construction.

Gas filled automobile lamp

Messrs. Weiss & Biheller (Canada), Limited, 19-21 Richmond Street West, Toronto, are distributing a folder describing their nitrogen gas filled automobile lamp, manufactured by the A. C. Mannweiler Company, Fort Wayne,



Ind., for which they are sole Canadian distributors. Their price list includes lamps rated from 6 to 60 c.p., designed to operate at voltages all the way from 6 to 21 volts. These lamps are claimed to have an average efficiency of ½ watt per c.p. Their type G 16½ is illustrated herewith.

Electrical equipment of Swing Bridge

Recently the C. P. R. reconstructed their swing bridge over the Lachine Canal, P.Q., in order to complete the double tracking of the line between Montreal and Brigham Junction, beyond Farnham. The bridge, designed by Mr. P. B. Motley, engineer of bridges for the C. P. R., is electrically operated, Mr. J. A. Shaw, the general electrical engineer of the company, being responsible for the electrical details. The weight of the whole swing span is 615 tons, while a 90-foot span weighing about 143 tons at the south of the bridge replaces an old 40-foot deck plate girder span and accommodates the existing roadway, and admits of the running of a future railway track along the south canal bank, if necessary.

The bridge is operated from a two-storey fireproof signal house on the north side of the bridge, which commands a view up and down the canal. Current is supplied by the Montreal Light, Heat & Power Company; there are two primary circuits, one being tapped off on the north side of the canal and brought into the operator's cabin to a double throw oil switch. The other primary circuit is tapped at the Lower Lachine road, and brought to the south side of the canal in an aerial lead covered cable, which is then carried

under the canal in an iron conduit to the other side of the double throw oil switch on the primary panel in the cabin. The centre of the switch is connected to the primaries of the transformers mounted outside the cabin; the secondaries of the transformers being connected to the main switch on the switchboard in the cabin.

Two 30 horse-power 540 r.p.m., 550-v., 3-phase motors, manufactured by the Wagner Electric Manufacturing Company of Canada, Limited, Montreal, are used for turning the bridge; these are of the wound rotor type, with variable speed, Canadian General Electric drum type controllers. The two motors operate in parallel, the controllers being interlocked. There is also one 30 h.p. motor for operating the wedges, which obtains its current from contactors placed on the end of the bridge and on the face of the abutment. Current is brought from the pivot pier to the turning motors located on the revolving portion of the bridge through nine concentric collector rings and brushes. A Westinghouse ½ horse-power 1,700 r.p.m., 550 v. motor is installed on the rest pier for operating the latch to hold the bridge in position when open.

The cables for feeding the motors are in duplicate, and consist of armoured submarine cable supplied by the Eugene F. Phillips Electrical Works, Limited, Montreal, and aerial cable supplied by the Standard Underground Cable Company of Canada, Limited, Hamilton. The underground cables are run in a chase cut through the canal bank and in a chase in the canal bed, and are carried in 6-in. conduits through the centre of the pivot pier. They are terminated in waterproof iron boxes with double throw switches, which with the double throw switch in the operating tower, enables them to be thrown over in case of disablement of any cable. There are G & W. potheads on the primary and Standard Underground potheads on the secondary cables.

The bridge is protected by an interlocking device which will prevent the bridge being opened before the wedges have been drawn. The device also makes it impossible to close the wedges before the bridge has been closed. The motors are equipped with solenoid brakes which are applied automatically when the power is turned off. Special switches are installed which must be operated through a master lever of the interlocking system before the current is permitted to flow to the motors. The latter are enclosed in iron boxes to protect them from the weather.

The grid resistances are mounted on a shelf swung beneath the operating floor of the cabin. The switchboard has been specially designed, and is equipped with Weston voltmeter and ammeter. There are two despatchers' telephones in the cabin, one going to Windsor Station and the other to different stations in the terminal.

The transformers are three in number, and step down the current from 2,200 v. to 550 v. There is also a 2,200/110 v. lighting transformer, the tower, bridge, and signals being electrically lighted. A special device is also installed to indicate to the operator when the bridge is nearly closed and closed respectively. All leading wires are placed underground.

Prest-O-Lite Company expanding

Announcement is made by the Prest-O-Lite Company, Inc., Indianapolis, Ind., that they have taken over the entire business assets and patents of the Pumpelly Battery Company, of Indianapolis, and, with some newly added features will continue to manufacture this battery. For the present the Pumpelly battery will be manufactured in the old Pumpelly plant, which has a present capacity of about 400 per day. Mr. Harry Murphy, president of the Pumpelly Battery Company, becomes vice-president of the Prest-O-Lite Company, and will have active charge of the Battery Department.

Current News and Notes

Brandon, Man.

The Brandon Electric Light Company, Mr. G. A. Patterson, general manager, offers the city a power contract to operate the municipal electric railway system at a 2 cent per kw.h. rate if a two-year contract is signed, and a 1½ cent per kw.h. rate if a ten-year contract is given. The original contract was for two years at the 2 cent rate, but this contract has now expired.

Calgary, Alta.

Negotiations are still proceeding between the city and the Calgary Power Company. It is proposed that the company take over the operation of the city's steam plant and use it only as a stand-by. The city expects in this way to effect a saving of from $25,000 to $35,000, as the operation of their steam plant has been an item of considerable expense, which would thus be done away with.

Formosa, Ont.

The Formosa Electric Light Company, Limited, has obtained a charter.

Fredericton, N. B.

The gross earnings for the year ending March 31st, 1915, of the New Brunswick Telephone Company, were $455,066, as compared with $422,700 the year previous. The following officers were re-elected: president, S. H. White; first vice-president, Senator Thompson; second vice-president, Lieut.-Col. Black; directors, A. W. Bennett, H. P. Robinson; secretary-treasurer, A. W. Mackin.

The New Brunswick Telephone Company, at their annual meeting, voted another $1,000 to the Patriotic Fund. This is in addition to two similar donations already made for patriotic purposes.

Granby, Que.

Mr. W. B. Powell, general manager, Montreal & Southern Counties Railway Company, has announced that his company will proceed with the completion of the line to Granby without further delay.

Hamilton, Ont.

The Hydro Board is considering the issue of debentures to the amount of $240,000, for carrying on new construction work.

Montreal, Que.

Messrs. Sevigny & Lalonde, electricians, Montreal, Que., have dissolved.

The annual statement of the Montreal Light, Heat & Power Company indicates that a donation of $10,000 was made to the Patriotic Fund.

Danford & Company have registered in Montreal, P.Q., as electrical contractors.

The Canada Grip Nut Company, Limited, Montreal, have removed from the Eastern Townships Bank Building to the McGill Building.

Mr. James Kent, whose retirement from the position of manager of the C. P. R. telegraph system was recently noted in our columns, has been presented with a handsome case of tableware by the officials, agents and chief operators of the department in the principal cities. The presentation was an expression of the esteem in which Mr. Kent was held during twenty-nine years' service.

Work has been commenced on the second addition to No. 1 elevator of the Montreal Harbor Commissioners. The addition will involve the extension of the electrical plant, the elevator system being electrically operated. When the first addition was made, the plant was enlarged and rearranged, and the second one will mean that more space will be required for the department.

Having secured the necessary finances, the Montreal and Southern Counties Railway is proceeding with a further extension, between St. Cesaire and Granby, a distance of 16 miles. A sub-station is to be constructed at the latter place.

Lieut. Maxwell, wounded at the front, was in the employ of the Northern Electric Company, Montreal, while Private C. B. Denman, who died at Huddersfield, Eng., from wounds received at Langemarck, was formerly in the electrical supplies department of Munderloh & Company, Montreal. In a letter from the front particulars are given of the heroic conduct of Major Andrew McNaughton, formerly of the electrical department of McGill University. During the battle of Langemarck, Major McNaughton insisted on directing his battery for twelve hours in spite of being almost helpless owing to a wound.

Peterborough, Ont.

The United Incandescent Light Company, Limited, Peterborough, Ont., has obtained a charter.

Quebec, Que.

La Compagnie de Developpement Electrique, Limitee, has been incorporated in Quebec, Que.; capital $149,900.

The Royal Trust Company have announced that the entire plant of the Dorchester Electric Company will be offered for sale by auction at Quebec on June 30th.

Revelstoke, B.C.

The Electrical Department are in the market for a quantity of 3-conductor, 2500-volt, 3/0, lead-covered cable and No. 10, 2-conductor, 600-volt, lead-covered cable with inside and outside cable terminals. The contract for building the power house extension has been let to G. D. Shaw, Revelstoke.

Ridgetown, Ont.

The Hydro-electric by-law, authorizing an expenditure of $15,000 on a distributing system, carried by a good majority.

Shelburne, Ont.

The town council decided to install a new street lighting system to consist of sixty-two 150-watt tungsten lamps.

St. Felicien, Que.

La Compagnie Hydraulique de Saint-Felicien, Limitee, has been incorporated in St. Felicien, Que.; capital, $49,900.

Three Rivers, Que.

Work has been commenced on the construction of the electric railway line at Three Rivers by the Three Rivers Traction Company.

Vancouver, B.C.

The passenger returns of the B. C. E. R. Company for the month of April show the number of passengers carried as 1,788,304, as compared with 3,263,125 in the same month a year ago. The city's percentage of the company's receipts for the month amounts to $2,081.28, as compared with $5,209.73 last year.

Winnipeg, Man.

Messrs. N. Kaplan & Company, electricians, Winnipeg, Man., have discontinued business.

Condensed Department

Publisher's Notice

Advertisements under "Situation Wanted" or "Situation Vacant" are charged at two cents a word per insertion, minimum charge 50 cents.

Advertisements for tenders, equipment, wanted or for sale, etc., or miscellaneous, are charged at $2.10 per inch.

All advertisements must be in the publisher's hands by the 10th or 23rd of the month to insure insertion in the subsequent issue.

Salesman Wanted

Wanted: Salesman electrical supplies, preferably Montreal resident, acquainted with electrical trade Eastern Canada. Address Box 205, Electrical News, Toronto. 12

POSITION WANTED

Electrical Engineer (age 28), with theoretical and practical knowledge of operation and test of electrical machinery and control, desires position with power or industrial company. Box 203, Electrical News, Toronto. 11-12

Book For Sale

Electricity for everybody by R. Borlase Matthews, Published in 1912 by the Electrical Press, Limited, London, England. 316 pages, illustrated. Price 75c.

Lighting Schedule July, 1915

Courtesy of the National Carbon Company, Cleveland

Date	Light	Date	Extinguish	No. of Hours
July 1	8 00	July 2	0 00	4 00
2	8 00	3	0 20	4 20
3	8 00	4	0 50	4 50
4	8 00	5	1 10	5 10
5	8 00	6	1 30	5 30
6	8 00	7	2 00	6 00
7	8 00	8	2 40	6 40
8	8 00	9	3 20	7 20
9	8 00	10	3 50	7 50
10	8 00	11	3 50	7 50
11	8 00	12	3 50	7 50
12	8 00	13	3 50	7 50
13	8 00	14	4 00	8 00
14	8 00	15	4 00	8 00
15	8 00	16	4 00	8 00
16	8 00	17	4 00	8 00
17	8 00	18	4 00	8 00
18	7 50	19	4 00	8 10
19	7 50	20	4 00	8 10
20	7 50	21	4 00	8 10
21	10 40	22	4 00	5 20
22	11 30	23	4 00	4 30
24	.0 40	24	4 00	3 20
25	2 00	25	4 00	2 00
26	No Light	26	No Light	
27	No Light	27	No Light	
28	7 50	28	10 10	2 20
29	7 50	29	10 30	2 40
30	7 50	30	10 50	3 00
31	7 40	31	11 10	3 30

Total Hours............166 20

Electrical News

Generation, Transmission and Application of Electricity

Published Semi-Monthly By

HUGH C. MACLEAN, LIMITED

HUGH C. MacLEAN, Winnipeg, President.

THOMAS S. YOUNG, General Manager.

HEAD OFFICE - 347 Adelaide Street West, TORONTO
Telephone A. 2700

MONTREAL - Tel. Main 2299 - Room 119, Board of Trade
WINNIPEG - Telephone Garry 856 - 302 Travellers' Bldg.
VANCOUVER - Tel. Seymour 2013 - Hutchison Block
NEW YORK - Tel. 3108 Beekman - 1226 Tribune Building
CHICAGO - Tel. Harrison 5351 - 1413 Gt. Northern Bldg.
LONDON, ENG. - - - - - - - 16 Regent St. S.W.

ADVERTISEMENTS

Orders for advertising should reach the office of publication not later than the 5th and 20th of the month. Changes in advertisements will be made whenever desired, without cost to the advertiser.

SUBSCRIBERS

The "Electrical News" will be mailed to subscribers in Canada and Great Britain, post free, for $2.00 per annum. United States and foreign, $2.50. Remit by currency, registered letter, or postal order payable to Hugh C. MacLean, Limited.

Subscribers are requested to promptly notify the publishers of failure or delay in delivery of paper.

Authorized by the Postmaster General for Canada, for transmission as second class matter.

Entered as second class matter July 18th, 1914, at the Postoffice at Buffalo, N.Y., under the Act of Congress of March 3, 1879.

Vol. 24 Toronto, July 1, 1915 No. 13

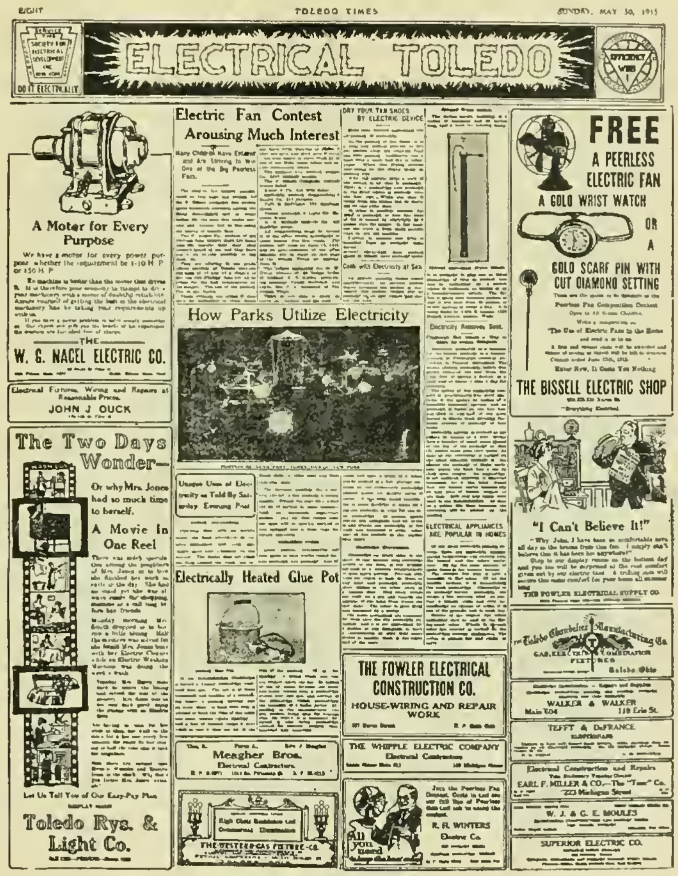
The Electric Page

The effectiveness of advertising depends largely on the methods employed to make it effective. It is possible to spend much money and get little result, but, on the other hand, small outlays, judiciously placed, have been the means of building up many an enterprise.

The advertising of electricity and electrical devices can be said to stand on a different footing from that of other articles to be retailed. For this very reason the use of established methods of publicity have often failed to give satisfactory results. This difference lies chiefly in the fact that the merchandizing of electricity is in its infancy. The advertising required, therefore, is more a matter of education, of attracting the attention of readers to general rather than specific or individual features. The reader needs to be impressed with the importance of electricity and its wide application before he is likely to become interested in isolated cases. He has got to be made to realize that electricity is now a real force in our daily work whether in the factory, the office or the home—and being a force it becomes a necessity.

It follows that the most effective form of advertising is that which best tends to impress the reader with the importance of the subject. Small and isolated advertisements are not likely to have this effect. Full page co-operative advertising, on the other hand, has been found to give gratifying results. In the United States this has often taken the form of an electrical page in a local newspaper, which means that one whole page, or as much of it as can be used, is given over to announcements of the central station, the dealers and the contractors in that centre, these all being grouped together without any matter of another nature intervening. This impresses the reader with the importance of electricity. Further than that, it tells him where to look for all the electrical information contained in the paper, instead of having to search through every page. He receives in a general way the impression that here is a pretty big enterprise, with confidence in itself, and as such worthy of investigation, and if you can get the public into an enquiring frame of mind regarding the merits of electricity and its applications the battle is half won, for it "speaks for itself."

We reproduce herewith, in much reduced form, a page of a Toledo paper which recently proved its value to the central station and electric merchants of that city. The Society for Electrical Development, who have carefully


EIGHT TOLEDO TIMES SUNDAY, MAY 30, 1915

ELECTRICAL TOLEDO

Electric Fan Contest Arousing Much Interest

A Motor for Every Purpose

THE W. G. NAGEL ELECTRIC CO.

JOHN J. OUCK

The Two Days Wonder—

Or why Mrs. Jones had so much time to herself.

A Movie In One Reel

Toledo Rys. & Light Co.

How Parks Utilize Electricity

Electrically Heated Glue Pot

Meagher Bros.

THE FOWLER ELECTRICAL CONSTRUCTION CO.

HOUSE-WIRING AND REPAIR WORK

THE WHIPPLE ELECTRIC COMPANY

R. R. WINTERS

FREE

A PEERLESS ELECTRIC FAN

A GOLD WRIST WATCH OR A GOLD SCARF PIN WITH CUT DIAMOND SETTING

THE BISSELL ELECTRIC SHOP

"I Can't Believe It!"

THE FOWLER ELECTRICAL SUPPLY CO.

WALKER & WALKER

TEFFT & DeFRANCE

EARL F. MILLER & CO.

W. J. & C. E. MOULES

SUPERIOR ELECTRIC CO.

The electric page as a business getter.

studied the results of this and similar forms of publicity, are very favorably impressed with the business-getting value of such advertisements. We believe it can be worked out in Canada with excellent results.

No Convention this Year

The Executive Committee of the Canadian Electrical Association have decided to dispense with the usual annual convention, being unwilling to ask the members of the association to incur any unnecessary expense at this time. In place of the convention, the committee have called a one-day meeting of representatives of operating companies, which is being held in Ottawa on June 26th. Reports will be presented by the various committees, and brief discussions in connection with them will be allowed. The discussions and reports will be printed after the meeting and distributed to the members as usual. The time will, of course, be chiefly occupied with matters concerning the affairs of the Class A

members. The relations between public service corporations and the public will be dealt with, it being the universal desire of the Class A members of the association to cultivate a friendship with their clients and with the public at large, which will be satisfactory and profitable to both sides.

Using Up Scrap Nickel

Some important experiments in the welding of nickel anodes by the oxy-acetylene process have just been concluded in the plating department of The Prest-O-Lite Company, Inc., at its Indianpolis plant. As a result of these experiments and tests, worn nickel anodes which have previously been scrapped and sold at less than half price are now being reclaimed at a saving of more than 100 per cent.

The anodes used by the Prest-O-Lite Company are castings of 90 per cent. nickel, 8 per cent. carbon, and 2 per cent. iron. They are elliptical bars approximately 1½ in. x 3½ in.

Scrap anodes welded for further use.

cross section by 30 in. long, and weigh about 30 lbs. Their market value varies between 46c. and 50c. per lb. On the basis of the latter price, each 30 lb. anode has a value of $15.00. By welding up old anodes which have been in the solution, and which have a junk value of between 22c. and 25c. per lb., this company are now converting their entire pile of scrap nickel into what are practically new anodes, at a total cost for gas and labor of less than 6 cents per lb. This estimate is based on a recent test at Indianapolis in which 421 lbs. of scrap anodes were welded up at the following costs:

463 cu. ft. oxygen at 2c.	$9.26
480 cu. ft. acetylene at 2c.	9.60
24 hours labor at 25c.	6.00
Total cost	$24.86
Cost per lb.	.059

In view of the fact that this test was made before any experience in the operation had been gained, it is apparent that better results and greater savings should be the result of practice.

The method of handling this operation is about as follows: As the anodes are eaten away by the solution they are turned over to an oxy-acetylene welder who "tacks" on scraps of old anodes by welding to increase the surface. One, two, three and sometimes four pieces of scrap are welded on, depending on the size and weight desired. The welding flame is also employed to remove the brass hooks which are used to support the anodes while in solution. Under the intense heat of the oxy-acetylene flame (approximately 6,300 deg. F.) the solder melts away rapidly, leaving a pure nickel bar which is later welded up. No flux is employed as this has been found to be unnecessary.

Mining Company Adding to Equipment

The Britannia Mining & Smelting Company, Howe Sound, B.C., are arranging to install in connection with their mine haulage system a motor-generator set for supplying direct current at 550 volts to the trolley. This set will consist of one 300 kw., 600-volt commutating pole type railway generator, 900 r.p.m. direct-connected to one 500 kv.a. self-starting synchronous motor, 3-phase, 60 cycles, 6,600 volts. One 15 kw., 125-volt commutating pole exciter will also be mounted on the same shaft with the main machines. This unit will be of the 3-bearing type, and the motor end of the shaft will be extended for the reception of the runner of an impulse water-wheel which may be installed at a future time. The synchronous motor will have a large capacity for power-factor correction.

These features will make the set very complete, inasmuch as the synchronous motor may be used as an alternating current generator, and when the water-wheel is in operation it would be unnecessary to use a hydraulic governor, as the synchronous motor, being attached to the main alternating current system, will maintain a constant speed.

This motor-generator set, together with the necessary switchboard panels and starting equipment, is being supplied by the Canadian Westinghouse Company.

A Three Million Corporation

A Quebec despatch reports the incorporation, under a provincial charter, of a hydro-electric power company with a capital of $3,000,000, with the object of developing and supplying power in the cities of Quebec and Three Rivers, and operating in the counties of Quebec, Levis, Beauce, Dorchester, Portneuf, Montmagny, Megantic, Champlain, St. Maurice, Charlevois and Saguenay. The incorporators are Messrs. C. H. Branchaud, of the firm of L. G. Beaubien & Company, brokers; Milton L. Hersey, engineer; Howard Murray, treasurer and director, Shawinigan Water and Power Company; Thomas McDougall, vice-president of the same company; Julian C. Smith, chief engineer and vice-president of the same company. Messrs. Branchaud and Milton Hersey are directors of the Dorchester Electric Company.

Giving Low Rates

At the annual meeting of the Montreal Light, Heat and Power Company, on June 2, the following directors and officers were re-elected: Sir Herbert Holt, president; Sir Rodolphe Forget, M.P., vice-president; Hon. Robert Mackay, Sir H. Montagu Allan, C.V.O.; Hon. H. B. Rainville, C. R. Hosmer, George Caverhill, Hon. Narcisse Perodeau and J. E. Aldred; J. S. Norris, general manager and secretary-treasurer. Sir Herbert Holt declared that the city were getting the lowest rates for light, heat and power of any important city on the continent. The greater part of the $2,881,197 set aside for maintenance will be used for improvements to the service.

Winnipeg L. & P. Dept's Fine Showing

"Although nine of the twelve months in the third fiscal year were affected by a curtailment of business due to the war, the whole year shows an increase of 13.7 per cent. in gross billing, 15.4 per cent. increase in realizable earnings, and 17 per cent. in net receipts over the preceding fiscal year." So reads a recent report submitted by the Winnipeg light and power department to the fire, water and light committee.

Gross billings for the year just closed were $1,084,358.23, compared with $953,882.88 for 1914, and $637,729.71 for 1912-13. Net cash receipts for 1914-15 were $947,982.60; $809,-966.74 for 1913-14; and $520,760.57 for 1912-13. Realisable earnings for 1914-15 were $971,799.49, and the previous year $842,368.42.

Few companies, the report says, can show as encouraging a report. Another encouraging feature is the state of the collections. Accounts outstanding on April 30 of this year amounted to $139,973.13, which is an increase of $21,-579.03. The allowance for bad debts brings this down to $9,579.03 or an increase of less than one per cent.

There are 3,193 lamps on the streets at the present time, which is an increase of 235 lamps over last year. The average cost per arc lamp per year, including interest, sinking fund, renewals and operating expense was $65.18. Mr. Glassco's estimate for the year was $135,000, while the actual expense totalled $125,872.59, showing a credit balance of $8,127.61. Capital expenditure for the fiscal year ending April 30 was $56,510.56, and for the preceding year $70,998.62. The department therefore reduced the expenditure during 1914-15, it being $14,488.06 less than for the previous year.

Montreal Underground

The City of Montreal having finished the underground conduits on St. Catherine Street, from Atwater Avenue to Papineau Avenue, and on Bleury Street and a portion of Park Avenue, have decided to instal a fire alarm system on those thoroughfares. Tenders have been received for the necessary work, the Gamewell system of fire alarm boxes, positive non-interfering succession type being specified. The tenders called for the supply of 83,700 feet of 20 conductor No. 16 B & S and 11,000 feet of 6 conductor No. 16 B & S cable, together with 10,000 feet of messenger wire for aerial cables. Forty street box pedestals of iron, of the Metropolitan design, are to be installed, the centre of the fire signal box being approximately 5 ft. 3 in. above the ground line. The two terminal posts for trunk cables, fitted with the cross arms for the aerial cables, will be of the same design as the pedestals. There will be thirty-six cable terminal strips having a capacity of ten pair and four cable terminal strips having a capacity of twenty pairs.

The feeder cables are to be brought from the conduits into the bases of the street box standards, and connected to the cable terminals at the back of the pedestal. The fire alarm box of the pedestal will be connected from its line terminals in series with one of the conductors of the feeder cable, and all the other conductors of the feeder cable will be connected across the cable terminal, so as to form continuous conductors throughout its entire length. Sixteen fire alarm boxes in private institutions are to be connected in a similar way from the nearest fire alarm box to the private institution by means of a 6 conductor cable, running from the nearest fire alarm cable box to the special cable box terminals located in the private institution which will in all cases be installed as near the street line as possible. From this point the private fire alarm cable boxes will be connected by means of at least four single conductor wires, run in ¾-in. iron conduit. A slate panel 8 feet wide by 4 feet high and one inch thick, having twenty terminal strips of twenty-five pairs each, without fuses mounted thereon, is to be mounted to the wall in the terminal room. Each fire alarm box will be provided with a telephone jack.

The Successful Operation of a 1,000 kw. Synchronous Booster Rotary Converter

By O. H. Hutchings

The Dayton Power and Light Company in 1913 found it advisable to increase their converting capacity for supplying their direct-current three-wire system. The question of whether it would be a motor-generator set or a rotary converter was very carefully considered by the company's engineers, and the latter was finally decided upon for the following reasons: (1) smaller conversion losses; (2) less current required for starting; (3) lighter weight; (4) less floor space.

The equipment was purchased from the Westinghouse company, and consists of one 1,000 kw., 4,000 ampere, 250 volt (voltage range—213 to 288 volts), 6 phase, 60 cycle, synchronous booster rotary converter, operated from three 365-kv.a. single-phase transformers (primary voltage—13200-6600-2200—secondary voltage that necessary for 250-volt rotary operation). At the present time this unit is operated from a 2200 volt sub-station bus, but the other voltages were provided to enable it to be operated at a higher voltage, which will be obtained later when other improvements that are now contemplated will be completed. This equipment is arranged for both alternating and direct-current starting, and requires less power for either method of starting than a synchronous motor-generator set of equal capacity. The operators all show a preference for the booster converter, as it has proved itself a very easy machine to handle; consequently it is in operation a good portion of the time. The d.c. voltage can be varied at will from the switchboard by means of the small booster field rheostat.

This unit has been in operation for approximately seventeen months, and is loaded daily up to approximately 4400 amperes, which is a 10 per cent. overload at the normal voltage. During one extreme condition the machine delivered 5500 amperes at 230 volts, for approximately fifteen minutes. This was due to a voltage disturbance, which caused the motor-generator, with which the rotary was operating in parallel, to fall out of step and disconnect itself from the line. During December, 1914, the converter operated normally eighteen hours a day and the average load factor for the month, taken from the station operating log, proved to be 79 per cent., ranging from a minimum of 70 per cent. to a maximum of 89 per cent. daily. In every sense of the word the booster converter has met the exacting requirements of central station operation in a manner entirely satisfactory to the Dayton Power and Light Company. There seems to be no logical reason for retaining a prejudice against sixty-cycle converters, since the machines built today have eliminated the objectionable points that were characteristic of those of earlier design. This is certainly borne out by the operating results obtained in the Dayton installation and that of various companies using modern sixty-cycle synchronous converters.

First Sea Lord is M.I.E.E. and F.R.S.

Admiral Sir Henry B. Jackson, First Sea Lord of the Board of Admiralty in succession to Lord Fisher, is a member of the Institution of Electrical Engineers and a Fellow of the Royal Society, the latter as a result of original research in electrical physics. Sir Henry has always been particularly interested in the subject of wireless telegraphy, appreciating from the first its value in naval operations.

Hydro-Electric Plant on Rouge River

Bell Falls Development Adds 6,000 kv.a. to Company's Lines—Natural Conditions Favored Construction—Two-Circuit Aluminium Transmission Line

THE Hawkesbury Electric Light and Power Company have lately completed and put in operation their new hydro-electric development at the Bell Falls, on the Rouge River, about eleven miles from Calumet, Que. This development was started in the summer of 1913, but a considerable part of the work has been carried out since last July. The company's original power house of about 1,500 horse-power is situated on the Rouge River about six miles nearer to its confluence with the Ottawa River. The original transmission line supplies 3-phase current at 10,000 volts to the villages of Calumet and Grenville on the Quebec shore of the Ottawa River, and to the towns of Hawkesbury and Vankleek Hill in Ontario. The demand for industrial power in Hawkesbury was increasing, and the new power house at Bell Falls and the new transmission lines to Hawkesbury will bring about 5,000 horse-power to the market.

At the Bell Falls the course of the Rouge River encounters a natural obstacle formed by a spur of a hill running directly across the valley and narrowing the river channel to a gorge at the end of the spur. The river passes through the gorge over a natural fall of about forty feet, and at the head of this fall a dam has been built raising the water in the upper bay to 60 ft. above the level of the lower bay. This general

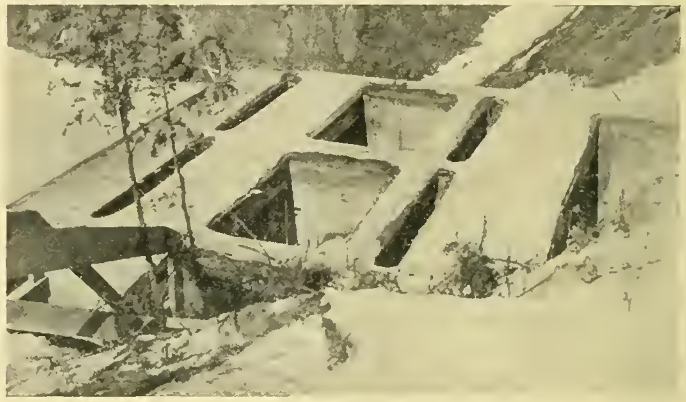
Power house.

configuration of the river course is somewhat common in the Laurentian district, perhaps the best known case occurring on the St. Maurice River, at Shawinigan Falls.

Head works of concrete, consisting of rack chambers with stop log checks, have been constructed on the upper bay, and a square tunnel 100 ft. long and of 17 square feet section has been driven through the rock spur, conducting the water to the fore bay and wheel pits on the hillside of the lower bay. The wheel pits, which are three in number, are open pits of reinforced concrete, with individual rack chambers, gates, and stop log checks. Two reinforced concrete wing walls running back to the tunnel entrance on the hillside form the fore bay. In each pit is placed a twin runner horizontal shaft turbine with shaft extending through the wall of the wheel pit into the generator room and directly connected to 3-phase, 60-cycle, 2,000 k.v.a. alternators developing current at 2,300 volts at 277 r.p.m.

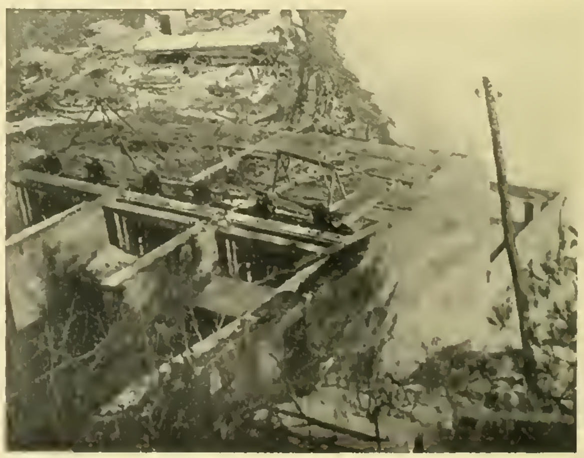
The draft tubes are constructed of reinforced concrete, and the generator floor is constructed above them.

The generator floor is constructed over the tail



Head works on upper bay.

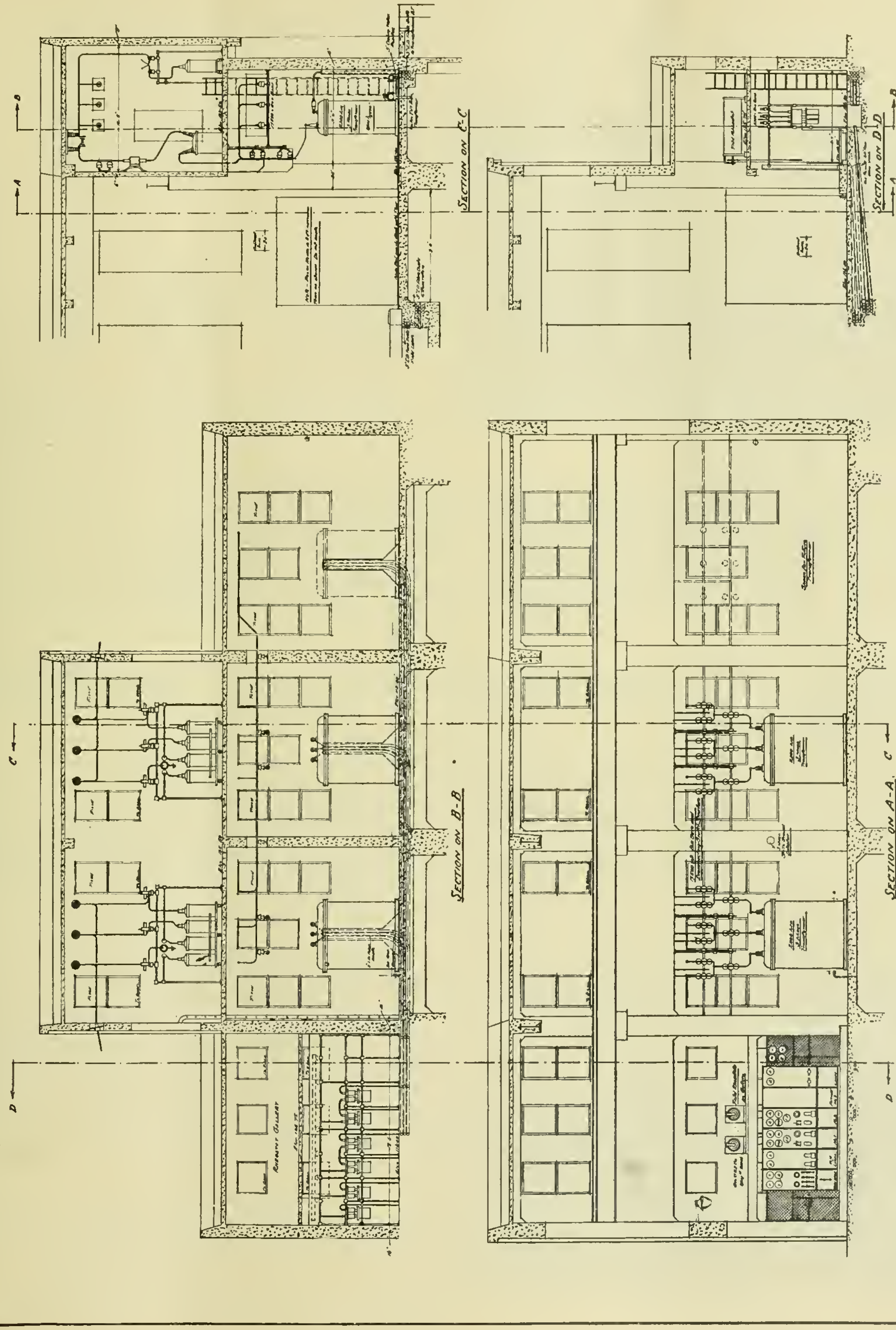
race for individual transformer chambers and switchboard chambers. Each chamber, which is about half the height of the generator room, is separated by a concrete barrier, but is open to the generator room. Thus transformers may be run out of their chambers on to the generator floor and handled on the travelling crane in the generator room. Slide rails embedded in the floor are provided in each transformer chamber for this purpose. Each transformer chamber is opposite the corresponding generator, and the switchboard chamber is at one end of the room, opposite the exciter bay. The generator field rheostats are located on a small mezzanine gallery above the switchboard. The line chamber is constructed above the two middle transformer chambers, and extends up to the level of



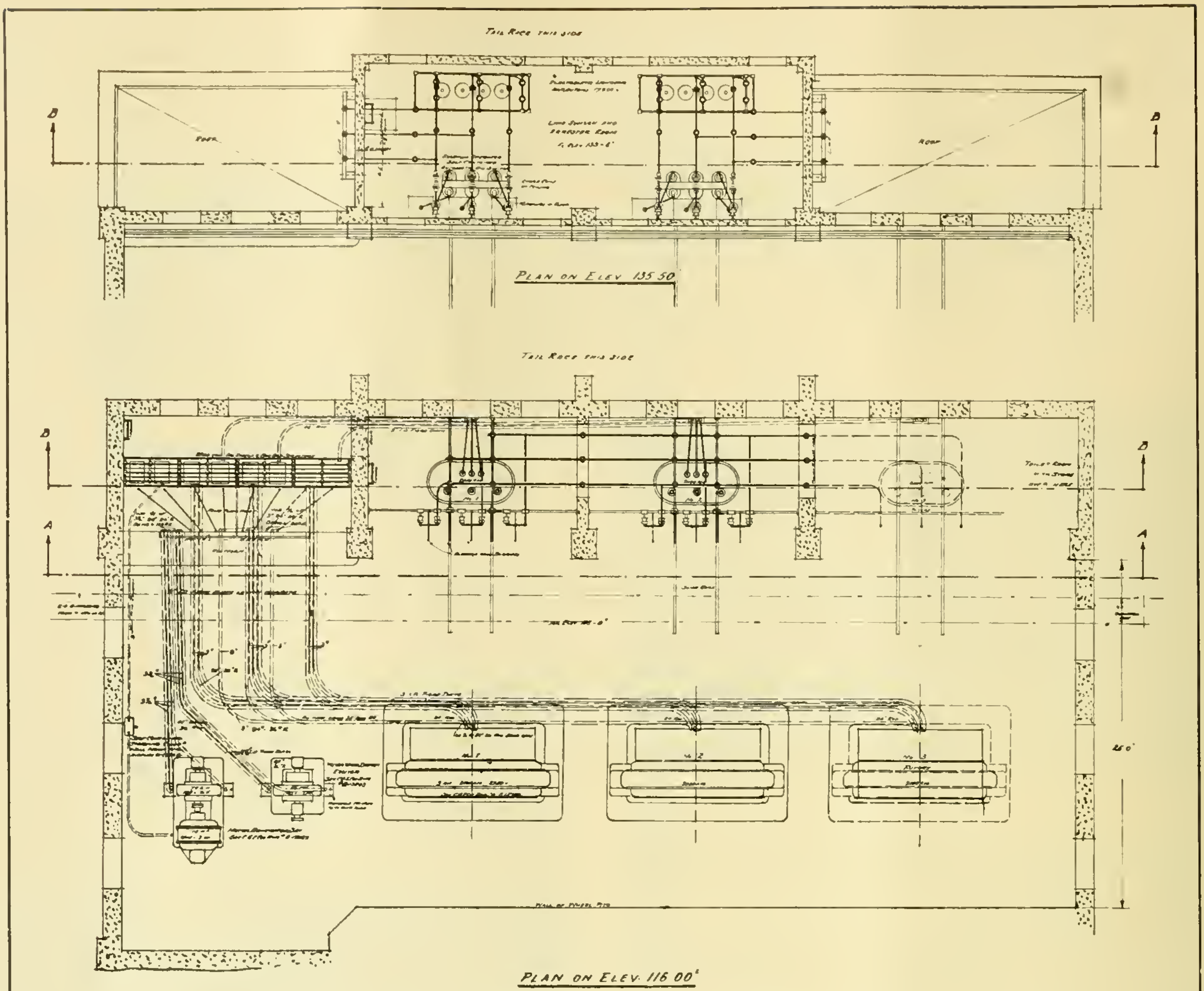
Fore bay and power house.

the generator room roof. One line is brought in at each end of this chamber.

Two exciters are provided, each capable of exciting



Sectional elevations of power house.



Plan showing general layout of power house.

the three alternators. One is driven by induction motor from the 2,300 volt bus bars; the other has an enclosed water wheel directly connected to it, taking water through an iron pipe penstock from the wheel pit of unit No. 1. The exciters operate at 720 and 600 r.p.m., respectively.

Laying submarine cable.

All 2,300-volt bus bars and switches are in the switchboard chamber, and are mounted on an iron pipe framework. The oil switches and circuit-breakers are mechanically operated from the panel board at the front of the chamber, which faces directly on to the generator floor.

The transformers, which are 3-phase, oil insulated, water cooled, and of 2,000 k.v.a. output, raise the voltage from the generator voltage of 2,300 volts to 17,500 volts for transmission to Hawkesbury, a distance of about fourteen miles. The 17,500-volt bus bar is located on the ceiling of the transformer compartments, and the two line oil circuit-breakers are immediately above it in the line chamber. These circuit-breakers are electrically operated by solenoid from the panel board on the generator floor. Two sets of electrolytic lightning arresters are provided, one for each line, and are installed in the line chamber.

The high voltage bus bar is merely a transfer bus and line; transformer and generator form a direct switching unit, the third generator and transformer being connected only through the transfer bus.

The low voltage switching arrangement is somewhat similar, the bus bar being used only for transfer

and synchronizing and for local service 2,300 volt supply.

Transmission Line

The transmission line consists of two 17,500-volt, 3-phase circuits, of 7-strand aluminium cable equivalent to No. 1 B. S. copper, carried on a single woodenpole line.

Near Calumet the line crosses the Ottawa River by means of two submarine cables, one connected to each circuit, but capable of carrying all the power over one line ni case of emergency. This river crossing has several features of special interest. The cables are directly connected to the transmission line, without the interposition of transformers. They are lead sheather and armored with galvanized steel wire and insulated with paper for a working pressure of 22,000 volts. Outdoor type terminals without any housing are used at the ends of the cables, which are continuous, without joint from shore to shore, each being 2,100 ft. long. The shipping weight of each drum was 38,000 lbs., and the drums were 9 ft. 6 ins. in diameter.

One cable was laid at a time. The cable drum was mounted on bearings in a crib on a scow, and payed out as the scow was towed across the river. The laying of one of these cables is illustrated.

The transmission line will feed direct into the substation at Hawkesbury, and there the power will be distributed partly at the line voltage and also through step down transformers over the 10,000-volt lines of the Hawkesbury Electric Light and Power Company in multiple with No. 1 power house.

The power house, dam and transmission line were constructed by the Hawkesbury Electric Light and Power Company, by day labor. The power house switching equipment was supplied and installed by the Canadian Westinghouse Company. Generators, transformers and exciters were supplied and installed by the Canadian General Electric Company. Water-wheels were supplied and erected by Canadian Allis-Chalmers, Limited. The submarine cable was supplied and installed by the Canadian British Insulated Cable Company.

Factory view of Bell Falls turbines.

The consulting hydraulic engineer on the work was Mr. Wm. Kennedy, Jr., of Montreal, and Mr. L. A. Herdt, D.Sc., was the consulting electrical engineer, assisted by Mr. E. Godfrey Burr, electrical engineer, Montreal.

Poles and Ties Used by Electric Companies

A bulletin dealing with poles and cross-ties purchased in Canada during 1914 has been prepared by the Forestry Branch of the Department of the Interior and will be published in the near future. The statistics in this bulletin are based on reports received by the Forestry Branch from 381 firms purchasing poles in Canada in 1914. These firms consisted of 209 telephone companies, 3 telegraph companies and 17 steam railway companies, forming one group; and 132 electric light and power concerns and 20 electric railroads forming another.

Wooden Poles

The activity of the different railways in extending their lines is one factor that affects these figures. Some of the provincial governments which control telephone companies purchase large stocks of poles and furnish these to small independent telephone lines. Their purchases are of necessity irregular and have fallen off considerably in the last two or three years, sufficient telephone accommodation having been established.

The purchases in 1914 show a decrease of 47 per cent. from those of 1913, while the average price paid increased by 11 cents.

Only nine kinds of wood were reported compared to twelve in 1913. Poles of oak, hard pine and Douglas fir were reported in 1914, but not in 1913. Decreases occurred with every other kind of wood, the greatest being in the case of tamarack, which amounted to 98.4 per cent. of the figures for 1913.

Eastern white cedar poles headed the list, their number forming over 85 per cent. of the total. Western red cedar from British Columbia and the Western States came second on the list, with over 12 per cent. of the total. Poles of these two woods have formed the greater part of the purchases in past years in spite of the increasing scarciey of good material, especially in the case of the eastern tree.

The steam railway, telephone and telegraph group of purchasers bought 65.7 per cent. of the poles as compared to 87.8 per cent. in 1913. Their purchases in 1914 showed a decrease of 60.4 per cent. from those of 1913. The oak, hard pine, jack pine and chestnut poles were all purchased by these companies. These companies reported the purchase of 442 treated poles.

The electric railway, power and light companies bought 34.3 per cent. of the poles as compared with 12.2 per cent. in 1913. Their purchases showed a decided increase (49.2 per cent.) over 1913.

Over half the poles purchased in Canada in 1914 were under 26 feet in length, the two cedar species forming 97.9 per cent. of the total in this class. These two kinds of wood formed over 95 per cent. in every length class recorded. Almost a quarter of the total number belonged to the next length, including poles from 26 to 30 feet in length.

The greater part of the white cedar, red cedar, spruce, tamarack and chestnut poles and all the jack pine poles belonged to the 20-25 foot class. Oak poles were mostly from 31-35 feet in length. The greatest number of Douglas fir poles were over 41 feet in length and all the imported hard pine poles were of this same class.

A total of 19,403,646 cross-ties valued at $8,664,914 were

Wood Poles Used by Electric Companies

Electric Railway, Power and Light Companies

Total	65,071	355,072	5.45	97,073	303,103	3.12
White Cedar	33,907	143,196	4.22	84,279	211,307	2.51
Red Cedar	29,855	205,749	6.89	12,290	90,016	7.32
Spruce	835	1,896	2.27	286	192	.67
Douglas Fir	......	....	....	155	1,485	9.58
Tamarack	305	3,007	9.89	63	103	1.63
Cypress	128	1,056	8.25	......	......	....
Western Larch ...	39	163	4.18	......	......	....
Hemlock	2	5	2.50	......	......	....

Steam Railways, Telephone and Telegraph Companies

Total	469,521	833,259	1.77	186,111	357,159	1.92
White Cedar	230,360	382,657	1.66	157,354	298,196	1.90
Red Cedar	115,714	282,389	2.44	24,066	48,492	2.01
Spruce	4,393	4,150	0.94	2,352	6,548	2.78
Tamarack	115,212	152,675	1.33	1,770	2,004	1.13
Oak	......	....	....	213	1,422	6.68
Hard Pine	......	....	....	126	252	2.00
Jack Pine	1,450	1,299	0.90	100	100	1.00
Chestnut	167	94	0.56	97	77	.79
Douglas Fir	......	....	....	33	68	2.06
Balsam Fir	1,437	1,841	1.28	......	.....	....
White Pine	682	8,095	11.87	......	.....	....
Hemlock	90	27	0.30	......	......	....
Ash	16	32	2.00	......	......	.....

Cross Ties Used by Steam and Electric Railways

Kind of wood	1913 Number	1913 Value	1913 Av. Value	1914 Number	1914 Value	1914 Av. Value
Total	19,881,714	$8,740,849	0.43	19,403,646	$8,664,914	0.45
Jack Pine	7,773,674	3,103,140	0.40	8,379,064	3,624,151	0.43
White Cedar	2,451,527	1,090,436	0.44	2,651,319	1,279,100	0.48
Tamarack	866,231	369,666	0.43	1,507,902	661,717	0.44
Douglas Fir	2,427,100	801,710	0.33	1,456,388	539,249	0.37
Hemlock	1,199,699	455,662	0.38	1,390,885	576,440	0.41
Western Larch ..	1,225,956	636,631	0.52	1,121,347	459,643	0.41
Spruce	458,256	151,049	0.33	1,020,667	379,841	0.37
Oak	978,554	673,244	0.69	617,449	483,496	0.78
B. C. Spruce	267,917	70,685	0.54	547,919	202,234	0.37
Hard Pine	1,138,351	621,032	0.55	378,983	263,215	0.69
Chestnut	232,179	126,795	0.55	104,980	69,091	0.66
Red Pine	114,852	52,112	0.45	81,979	30,923	0.38
Elm	13,674	6,421	0.47	33,307	27,030	0.81
Beech	96,923	60,552	0.62	32,637	25,331	0.78
Maple	16,860	14,381	0.85	22,449	19,995	0.89
White Pine	....	....	....	14,165	6,446	0.46
B. C. Cedar	115,578	77,328	0.67	13,817	4,554	0.33
Cypress	....	....	....	13,246	5,873	0.44
Birch	24,736	10,447	0.42	11,018	5,293	0.48
Western Hemlock	479,113	148,725	0.31	4,019	1,246	0.31
Ash	503	216	0.43	106	46	0.43
Cherry	31	17	0.55	....	....	....

Ties Purchased by Electric Railways

Kind of Wood	1913 Number	1913 Value	1913 Av. Val.	1914 Number	1914 Value	1914 Av. Val.
Total	391,223	$225,086	0.58	207,438	$119,857	0.58
Cedar	145,659	76,673	0.63	76,399	46,175	0.60
Tamarack	27,232	13,808	0.51	29,390	15,043	0.51
Jack Pine	66,954	33,137	0.49	23,546	13,266	0.56
Hard Pine	1,995	1,108	0.55	22,510	12,601	0.56
Hemlock	19,563	7,427	0.38	21,509	9,938	0.46
Oak	14,760	13,041	0.88	15,158	13,668	0.90
Cypress	......	......	....	7,816	3,517	0.45
Elm	3,348	1,981	0.59	4,334	2,403	0.55
Douglas Fir	5,982	2,439	0.41	4,150	1,875	0.45
Spruce	8,000	2,800	0.35	1,118	852	0.60
B. C. Cedar	95,000	70,567	0.74	1,208	519	0.43
West. Larch	2,512	1,889	0.75	......	......	....
Beech	152	152	1.00	......	......	....
Maple	61	61	1.00	......	..... .	....

purchased during 1914 by Canadian railways for use in Canada. These companies consisted of 47 steam railways and 31 electric roads. Of this total 1,447,576 ties were treated with preservatives to retard decay. This is about seven per cent. of the total as compared to ten per cent. in 1913.

The cross-tie purchases in 1914 showed a slight decrease of 2.4 per cent. from those of 1913, while the decrease from 1912 to 1913 was 6.7 per cent.

The greatest decreases from 1913 to 1914 were with the western species, Douglas fir, western larch, cedar and hemlock, and the imported woods such as oak, hard pine and chestnut. Of the twenty-one woods reported in 1914 eleven showed decreases.

Jack pine makes the most suitable tie material of the cheaper, more abundant woods of Canada. It has headed the list since 1911, when it took the place of white cedar, a more durable wood, but one of which the supply is rapidly becoming exhausted. These two woods have formed the greater part of the ties purchased in past years, and together formed over half the total in 1914.

The average prices paid for cross-ties by the railroads in 1914 showed only a slight increase over 1913. The prices in the last five years have been as follows:—1910, 38 cents; 1911, 39 cents; 1912, 44 cents; 1913, 43 cents; 1914, 45 cents.

The electric railways in Canada purchased 207,438 cross-ties or about 1.1 per cent. of the total. These roads had a mileage of 1,561 in June, 1914, and therefore purchased ties at the rate of 133 per mile. These purchases were mostly used for renewals for which the demand is not so heavy as in the case of steam railroads.

The total number in this case is a decrease of 47 per cent. from 1913, while the average price per tie is the same. The greatest decreases were with western and eastern cedar and jack pine. Eleven woods were reported in 1914, and 15 in 1913, western larch, beech, maple and white pine being dropped from the list.

High Voltage Transmission in Japan

A detailed description of a 115,000 volt hydro-electric system in Japan is published in the current issue of the Electric World. The transmission line is 145 miles long and its voltage is stated to be the highest operated outside of the United States. The system consists of one generating station containing equipment having a total rating of 46,662 kv.a., a double-circuit steel-tower transmission line passing through three equally spaced sectionalizing stations and a receiving sub-station which contains step-down transformers having a total rating of 48,000 kv.a.

The turbines operate under a hydraulic head of 350 feet and comprise six 10,000 h.p. horizontal, Francis type units direct connected to 7,777 kv.a., 6600 volt, three phase, 50 cycle generators designed to operate at 375 r.p.m.

Generator and Auxiliary Busbars

From each generator cables pass through ducts in the floor to disconnecting switches and oil switches back of the transformers and thence to the main 6600-volt busbars and auxiliary busbars on the gallery above. The main busbars, which are arranged in a loop, are sectionalized by disconnecting switches between each circuit connected thereto. Two oil switches are also provided to divide the loops into two sections. The main busbars feed step-up transformers as well as the station-service transformers. A water rheostat is also connected thereto for loading any machine. The auxiliary busbars are also sectionalized but are straight and arranged to energize 6600-volt outgoing feeders. Indoor-type aluminium-cell lightning arresters are connected through horn-gaps with the outgoing 6600-volt feeders. Zigzag multiple gaps connected in series with resistors are inserted between the low-voltage terminals of the main transformers and ground to protect them from static disturbances caused by arcing grounds on the 115,000-volt system, etc.

Step-Up Transformers

The step-up transformers consist of four banks of three 4400-kv.a., single-phase, water-cooled, oil-insulated, 6600/115,000-volt units connected in delta on both sides. They are mounted on trucks housed in individual masonry compartments along one side of the generating room, into which they can be transferred when overhauling is necessary.

Shell-type magnetic circuits are employed, and both high-voltage and low-voltage windings are made of flat coils having one turn per layer. Insulation on the coils nearest the terminals has about three times the strength of that on the intermediate coils. The insulation as a whole is designed to withstand double-rated voltage for five minutes.

Although designed for water-cooling, the transformers will operate satisfactorily without any circulation of water provided full load is not carried more than four hours, or one-half load more than eight hours. The transparent amber-colored mineral transformer oil employed has a flash point of 170 deg. C., a fire point of 190 deg. C., specific gravity of 0.86, and a dielectric strength of 30,000 volts between a 0.15-in. sphere gap.

Spare parts are kept in stock at the station so repair work does not have to be delayed by waiting for new parts from the manufacturers in America. The reserve set includes assembled high-voltage and low-voltage coils. In case a transformer is damaged, the entire winding may be removed and replaced by a serviceable set. When more time is available the damaged coil can be repaired by replacing faulty sections with units from the unassembled set.

Condenser-Type Terminals

One of the most important features of the high-voltage equipment is the use of condenser-type terminals for roof bushings and for the oil-immersed equipment. Each terminal consists of a metallic core, serving as the conductor, surrounded by alternate layers of shellac-coated micarta paper and tinfoil which grade off in length from the inner cylinder to the outer shell. Around the outer layer is a metallic cylinder consisting of closely wound wire soldered together. The end of the terminal that is not immersed in oil is inclosed in a casing of bakelite micarta, the intervening space being filled with insulating compound. Static shields are attached to the end of each casing for the purpose of preventing corona discharge.

115,000-Volt Busbars

The 115,000-volt terminals of each bank of transformers are connected by copper tubing attached to six-section insulators suspended from the ceilings of the compartments. From these busbars tubes extend up through openings in the floor of the high-voltage gallery to oil switches, thence to disconnecting switches, and finally to copper-tube loop-type sectionalized busbars attached to six-section insulators suspended from the roof trusses. Like the 6600-volt busbars, they are divided by disconnecting switches into as many sections as there will be circuits connected thereto. Three oil switches further subdivide the busbars into three

sections with one pair of transmission lines (future and installed) on each.

From the high-voltage busbars two circuits lead to disconnecting switches, thence through oil switches over to other disconnecting switches on the opposite wall from those first mentioned, and out through condenser-type roof bushings.

High-Voltage Disconnecting and Oil Switches

The high voltage disconnecting and sectionalizing switches are attached to rigid built-up porcelain columns, some of which are supported in horizontal positions and others vertically. The columns of indoor sets contain six sections, while those for outdoor use have ten. It has been reported that a force of 1,000 lb. transverse to the length is required to break such a column. The outdoor type will stand 287,000 volts in a rain test, while the flash-over pressure between columns in dry weather is 375,000 volts.

Each pole of the 115,000-volt oil-immersed circuit-breakers is installed in its individual welded-steel tank, the moving parts being operated simultaneously by a system of levers and links actuated by a horizontal rod extending through the heads of the tanks and connected with a single solenoid. The stationary contacts are screwed directly to the ends of the brass tubes extending through the condenser-type bushings. Series transformers, operating ammeters and relays are clamped directly around the bushing leads inside the tank. Such an arrangement permits the use of a simple, compact and relatively inexpensive form of current transformer.

High-Voltage Outdoor Equipment

The roof bushings are similar to the transformer terminals except that the micarta end casings are replaced by a series of brown-glazed porcelain shields cemented together to form a practically continuous porcelain tube. From the tops of these bushings conductors curve downward to special choke coils supported near the edge of the roof in a vertical position by horizontally projecting and specially guyed built-up insulators. The lower ends of these choke coils are connected with the dead-ended transmission lines and through horn-gaps with outdoor-type aluminium-cell lightning arresters.

Each set of lightning arresters consists of four single-phase cells supported on insulators, three of the units being connected in star with the lines, and the fourth joining the neutral with the ground. Auxiliary horn-gaps shunted by glazed carborundum-rod resistors are furnished to prevent surges when the arresters are being charged. Although the electrolytic cells are designed for a high discharge rate, they are equipped with fuses that will rupture in case a discharge continues long enough to overheat the arresters considerably.

Each 115,000-volt lightning arrester unit consists of two three-section columns of telescoping aluminium trays inclosed in micarta shields and submerged in tanks containing oil. The columns are connected in series, one terminal through an insulating bushing at the top of the case, while the other is grounded to the metallic case. As protection from lightning is seldom required in severely cold weather, special oil with a low freezing point is not employed in the lightning arresters.

Main Control Equipment

The main control board, which is of the desk type, is on a gallery overlooking the generator room. The central section of the board contains the control equipment for the exciters, the low-tension bus tie circuits and two local service circuits. The sections at the extreme right and left end control 6600-volt outgoing feeders, while the six remaining panels bear apparatus controlling the generators, transformers and incoming and outgoing 115,000-volt lines (both future and installed). Only instruments which are required in operating the station equipment are installed on the vertical panels over the desk. To facilitate calibrating these instruments, test terminals have been provided on the back of the board. On the front of the desk are six-button gang switches and indicating lamps for signaling operators at each generator and exciter. Similar signaling equipment is installed on pedestals beside each waterwheel so that the attendant can answer the signals sent from the control board. As both the positive and negative direct-current busbars are at the desk and near the pedestals, only one wire is required for each signal circuit.

Headgate control switches and indicating lamps are also placed on the control board. To open the gates the controllers must be held in the opening position, otherwise they will return automatically to the neutral point. When closing a gate, however, it is unnecessary to keep the hand on the controller as it will stay in the closing position, a limit switch automatically stopping the headgate motor. Overload relays are provided to protect the motors in case they become stalled. To prevent operators continually closing a switch after the overload breaker opens, as would probably occur if the relays were reset by remote control, the relays have been installed on a panel near the headgates where they have to be reset by hand. Master switches operating 1/6 h.p. series motor on the valves of the waterwheels are employed to regulate the speed of the turbo-generators.

Line-drop compensators have been provided so that the receiving-station voltage can be read on the generating-station instruments. In order that it shall not be necessary to synchronize on the 115,000-volt side of the transformers, the synchronizing receptacles have been connected with the low-voltage terminals. The receptacles are equipped with auxiliary contacts so that it is impossible to close a circuit-breaker before inserting the synchronizing plug. Miniature dummy busbars and pilot lamps are laid out on the panels to indicate the connections and positions of switches.

Calgary Offered Cheap Rates

The Alberta Hydro Electric Company, which proposes to construct a series of dams on the Bow River, within the city limits, for the production of electric power, has made an offer to supply power to the city at the following rates:—4,000 horse power at $22 per h.p,; the next 1,000 horse power at $21; the next 1,000 horse power at $20; the next 6,000 horse power at $19. The company asks for a clause in the contract to provide that, at the end of the five years the company shall supply then a minimum of 10,000 horse power on a renewed contract at the same prices. One of the greatest difficulties with water power companies in this district is the variation in flow from one season to another during the year. This difficulty has handicapped the operations of the Calgary Power Company and has been one of the factors deterring the city of Calgary from proceeding with the installation of their own hydro-electric plant. A favorable factor, however, in connection with the new company's proposition, is that there would be no long distance transmission lines to install and maintain.

Power Scheme to Cost Million and Half

In connection with the enlargement of the Montreal aqueduct and the generation of power for pumping and lighting purposes, the Board of Control have submitted an estimate of the cost of the hydro-power scheme. This is put at $1,500,000, but the expenditure will not be made for a considerable time.

The C. P. R. Telegraph Company will soon have complete telegraph communication over the Kettle Valley lines, between Midway and Merritt.

Electric Railways

A 4,000-Gal. Centrifugal Sprinkling Car

Several weeks ago the Scranton Railway Company received from the J. G. Brill Company a centrifugal sprinkling car, which is being used at present for flushing paved streets instead of sprinkling. It is operated from midnight to 5.00 a.m., or for as much time between these hours as is necessary. The company furnishes the car and crew, and the city provides the necessary hose, water and men to do the flushing. It is the only flushing car used in Scranton and is filled from the city hydrants.

The car is built on an underframe of long-leaf yellow pine side sills, 5½ by 11¾ in. The crown pieces are of 8 by 12-in. oak, the crossings of 3¾ by 8¾ in. oak and the stringers of 4⅜ by 8¾-in. yellow pine. Truss rods under each side sill are of 1⅛ in. diameter bearing on queen posts bolted to the sills. The bolsters are composed of 9 by ⅝-in. top plate and 9 by ⅞-in. bottom plate, with cast fillers. The steel tank is 5 ft. 4 in. in diameter by 24 ft. long and has a capacity of 4,000 gallons. It is provided with four Brill patented sprinkling heads, which are adjustable for both range and quantity of water. Gate valves are provided in each pipe line back of the sprinkling heads to enable the water to be cut off without disturbing the sprinkling head adjustment. On each of the pipes back of the gate valves a special valve is located, to which hose may be coupled for flushing purposes.

The centrifugal pump is located under the centre of the car and furnishes pressure to permit four lines of flushing hose to be used at the same time. The car is mounted upon Brill 50-E2 diamond-frame trucks and equipped with both hand and air brakes. The draw-bars, angle-iron bumpers, platform gongs, brake hangers, etc., are of Brill manufacture.

Summer Amusement Parks

It is up to our street railways to make the most, during the next three months, of their amusement features. The amusement park has been proven a very profitable venture, where properly organized, and the present season, when fewer of us will feel like making the bigger expenditures necessary for an extended summer outing, should prove an especially opportune time to take advantage of amusement and recreation points nearer home. Electric railways stand to profit by these circumstances.

To be operated on a profitable basis any such undertaking must, of course, be thoroughly and systematically advertised. Insufficient publicity has probably been responsible for more failures in this line than has bad management. Prominent newspaper displays, and announcements in or on the cars themselves, are among the best forms of publicity. A current issue of the Brill Magazine in this latter connection, prints a number of catchy sentences which we reproduce below, in the hope that our readers may find something seasonable for their own use:—

Amusement Park Advertisements

No one who has ever been to ——— Park is at a loss to know where to go to have a good time.

The healthiest, happiest hours are those spent out-of-doors. Go to ——— Park and come back refreshed and invigorated.

——— Park is for everybody's enjoyment, from the youngest to the oldest. Go and get your share of the pleasure.

The attractions of ——— Park speak for themselves! They tell you to come and be amused and interested! They also tell you to come again!

Plenty of fresh air, bright music, good dancing, fine boating and all sorts of wholesome recreation at ——— Park.

If you need rest and relaxation, or if you need exercise and livening up, you will find just what you need at ——— Park.

The real recreation spot within the horizon of your every-day life is ——— Park.

The right thing to take for the blues, a dull feeling or a headache, is a trolley car that will land you at ——— Park.

There is no place where you can get so much pleasure for so little money as at ——— Park. And it is the kind of pleasure that does you good!

The most popular park, the park which pleases particular people, the park with plenty of places for parties and picnics, the park that has all parts properly protected against possible danger to little patrons, the park par excellence is ——— Park.

For genuine pleasure go to ——— Park. Breathe deeply, smile broadly, laugh heartily! Feast your eyes on the gay and beautiful. Take your fill of good, healthy fun! Be young and happy at any age Today, this evening, go to ——— Park.

A comfortable, breezy, interesting ride to the most attractive place in the vicinity; a place that is splendidly prepared to give you thrills of pleasure at every turn; that is full of spontaneous gaiety and life, genuine amusement and recreation— ——— Park.

Cool groves and sunny lawns, brilliant flowers and sky-blue water, gay pavilions and bright music, rippling laughter and gleeful shouts, a whirl of life in many places, quiet nooks a plenty, a sound of oars and singing from the lake—that is ——— Park.

Have Asked Board's Consent

The Nova Scotia Tramways and Power Company are taking steps to carry into effect the legislation recently passed which enables them to take over the properties of the Halifax Electric Tramway Company, and the Nova Scotia Light and Power Company's hydraulic properties on the Gaspereau River. Before any progress can be made, however, it is necessary that the Board of Public Utilities Commissioners of Nova Scotia should grant their consent, and the first step taken by the company is in the form of a petition to this Board. It is also asked that the capital of the company be increased to $10,000,000.

Belleville Jitneys, Limited, Belleville, Ont., have obtained a charter.

The Dealer and Contractor

Credits, Collections and Cash Discounts

The subject is so broad and comprehensive that to do it full justice would require more time and thought than we can bring to its consideration to-day. Consequently I shall be brief and touch upon such points as I feel will best apply to the subject.

You are all familiar with the old adage "Money makes the mare go." Therefore, no difference how much business you get or how much profit you make (presuming, of course, that you are getting at least a fair margin of profit) if you do not make prompt collections your business is going to suffer for the want of money. In other words, the money that you should have in the bank is there to the credit of your customers. You all know that it is harder to collect over fifty per cent. of your accounts than it is to get the orders. If some method of overcoming this could be worked out it would make the work more pleasant and profitable.

The first subject to be dealt with is Credits, the vital force in our business transactions. Every contractor is hungry for business and there is a lot of it taken that if customer's credit standing would be carefully looked up it would be good business policy to absolutely refuse the order, unless a cash payment was made in advance.

The man who is frank and fair should always be given the most liberal treatment even though he be deeply in debt or has not much capital to start with. By cutting off the unworthy from credit we are in position to extend it to the worthy more than we ever could before. No man should be given credit beyond his means. Don't act hastily on requests for extensions. Apply to each case a thorough investigation, make your conclusion deliberately and with material on hand which insures a sound decision.

Credit information can generally be secured through local credit rating associations or mercantile agencies. We should be more than willing to impart credit information to competitive members of the Association for their guidance and the extension of credit favors, if this confidence would not be abused by its being used for any other than credit purposes. We should try to interest every eligible prospect in becoming a member of our organization in order that its efficiency may be increased. We should back up our faith in the organization by taking a greater personal interest in its welfare. The more efficient we make it the smaller our credit losses.

Get consensus of several opinions

It frequently happens that credit is asked by some local individual or combination of two or more men, whose financial responsibility is of a negligible quantity with small commercial rating or none at all. Naturally such cases require close scrutiny, and the granting of credit must be based largely on past and present business reputation, personal habits, location, probable earning power and the ability and desire to fulfill a reasonable credit contract. When such applicant is first embarking in business and seeking credit accommodation it is dangerous to place exclusive reliance in one's own investigation, as the one or more pertinent facts necessary to reach an intelligent decision may be overlooked or the personality of the applicant may be such that his powers of persuasion would overcome any misgivings you may have. It is, therefore, advisable that the consensus of several opinions be secured, and through the banding together of local electrical interests in what is termed a "Moral Risk Club," dealing primarily with risks of this character, with their exchange of intimate ledger data, possible prior knowledge of the applicant's past performances and the desire of the membership to co-operate in such matters for the benefit of the craft as a whole, you are frequently put in possession of reliable information that will either confirm or disprove any favorable action you may have contemplated.

In times past such brotherly feeling among competitors would have been looked upon as the approach of the millenium, and the slightest inkling of your inner affairs coming to the knowledge of your neighbor was not to be thought of. But here we have men in the same line of endeavor, freely discussing the value of an account, possibly of long standing with one or more of them, and frankly giving an honest estimate of the worth of the account under discussion with no fear that the information given will be used to his detriment. It is merely an exchange of business confidences among gentlemen, and the instances wherein this confidence has been violated are few indeed.

Credit risks are divided into two classes—Moral and Financial. Through the agency of credit rating associations and mercantile agencies we can secure unexcelled first hand knowledge of the financial status and personal responsibility of a concern which has been in business for a reasonable length of time, but with moral risks it is different. Here the personal equation enters, and it is only by the interchange of experience, ideas and advice through a Moral Risk Club that the information sought can be secured and relied upon. Therefore, if credits were properly looked up collections would be simplified.

Able and willing

An obvious seeming reply to the query as to when a delinquent account is paid is illustrated by the anecdote concerning a certain very "close" farmer whom the village storekeeper urged into a liberal purchase by agreeing to wait payment until the farmer was "able and willing" to pay. The story goes that promptly after the customary maturity date the storekeeper appeared at the farmer's door, bill in hand and accompanied by the town constable with summons in a suit for debt. To the farmer's protests the storekeeper answered, acknowledging the agreement, but explaining that he "knew as how he was able" and so just brought the constable along to insure willingness.

The point is that the time of settlement of an account due from a debtor who is delinquent and yet has the ability to raise the money for payment, is reached when the conviction takes hold upon the mind of the debtor that drastic action will immediately follow a failure to make payment forthwith.

Upon the effective development of this psychological state depends the degree of success of the collection department in handling this class of accounts. Methods such as

illustrated in the foregoing anecdote, though perhaps productive, leave something to be desired in the subsequent unamiable frame of mind of the debtor. It is even possible to collect with a length of gas-pipe as an argument, in some cases, but scarcely expedient as an established practice. In fact it may be admitted that the collection method which develops a state of mind that results in payment with promptitude and in a manner calculated to keep the good will of the debtor is the one nearest perfection. Even though the subsequent trade of the delinquent is not desired, it can scarcely be denied that his passive good will is preferable to his active and certainly to some degree damaging enmity.

Such a method may be worked out, and the desired psychological stage established in the debtor's mind, if only an understanding of what leads to that mental impression is had. A conviction that the limit of leniency has been reached is the crucial and underlying factor in establishing such an impression. Proof of this is afforded in the often observed fact that a creditor may exhaust himself in personal appeals, letters, duns and threats, the repetition of which defeats their own intent, and yet the first notification from a collection agency that the account has been placed in their hands, or from an attorney, brings the delinquent to payment with surprising suddenness. Here the passing of the account from the hands of the party with whom it was contracted into the hands of a second party for the express purpose of collection effects the purpose of convincing that the period of leniency is past, with the result that payment is made to avoid the consequence of suit.

Your own collector

The efficacy of this as a means of establishing the desired state of mind on the part of the delinquent renders it the usual procedure, yet a failure to appreciate the underlying reason for its efficacy is what causes merchants to pay commissions to collection agencies for the use of a weapon which can equally as well be used by the creditor's own collection department through the use of a logically devised series of steps leading up to and establishing a conviction that the account has been placed in other hands for the purpose of collection.

A vital requirement of such a plan is that it must not give rise to suspicion as to genuineness and it should also be logically consecutive in its steps, to the effect that the debtor realizes that a failure to pay at an earlier stage has resulted in the ensuing more urgent step and that the way points clearly from the first step to that eventual drastic step of turning it over for suit as an inevitable outcome of continued failure to pay.

Such a plan, with intelligently chosen steps, progressive and convincing, accomplishes all that can effectively be done in the way of pushing the class of accounts under discussion to collection and when the requirement of bringing into play the effect of turning it over to a collection agent is indicated, can operate with all the force that actually giving it into the hands of a collection agency would bring to bear.

Cost of collecting accounts

How many concerns are there that actually know what it costs them to collect their accounts? By taking into consideration collectors' salaries, attorneys' fees, stationery, postage, lost accounts, additional bookkeeping expense and interest on borrowed money (because your customer has your money in his bank) you will find that it is at least two per cent. of your gross business. The problem before us, therefore, is how best can the contractor eliminate this loss. First, by scrutinizing credits more closely. Second, by charging enough for work to allow a liberal discount for prompt payment. If work is priced out as suggested by the National Electrical Code price book you can afford to allow a cash discount of 5 per cent. if the account is paid within ten days from date of billing. Most of us allow customers to take two per cent. thirty days as we do not wish to offend them by returning their checks. However, we are not charging enough for our labor to allow as liberal a discount as this. Therefore, I would suggest that we charge more for our labor and that no charge of less than $1.00 for time be made on any job, for unless you get at least this amount you are presenting your customers with part of your profits. Now let us take an example. Twenty hours at 75c. equals $15.00, less 2 per cent. discount would be $14.70. Twenty hours at 80c. equals $16.00 less 5 per cent. would be $15.20. You would, therefore, receive 50 cents more for this same work, get your money promptly and very materially cut your cost of collections and lost accounts. You also make the customer who fails to take advantage of the liberal discount pay for collecting his account.

The above proposition would have to be worked out in each individual locality according to conditions. It is all a matter of education. Like charity, this education must begin at home. Educate the trade to understand that cash discount is a premium for the payment of an invoice within ten days, or whatever the period, before it becomes due, and that cash in ten days does not mean cash in fifteen, twenty or thirty days, for at that time it is no longer a cash discount. Therefore, it would be necessary to have all invoices plainly showing the terms of settlement. This proposition should apply to time and material work only.

It would be well if the association would get up a regular printed form, and when improper deductions are made, because the cash discount period is past, to simply pin this form to the check and mail it back to the offending debtor. Punctilious observance of sales terms is one of the best evidences of business integrity and good faith. You would object if a man put his hand in your pocket and took something that did not belong to him, and taking cash discount after the discount period is past is taking something that does not belong to him.

Successful business demands prompt collections and payments, and a closer observance of credits, a proper system of collections and a more strict adherence to discounts will make your business more profitable.

Personal

Mr. W. M. Marshall, assistant general manager of the C. P. R. telegraphs, with jurisdiction over lines west of the Great Lakes, was operated upon recently in Winnipeg for appendicitis.

Mr. H. T. Matthew has been appointed Pacific Coast representative for the Society for Electrical Development. Mr. Matthew, who is a son of Dr. George F. Matthew, a noted Canadian paleontologist, was born at St. John, New Brunswick, Canada, in 1878. He received his early training in local public and private schools. Going to the United States in 1898 he entered the employ of the McGraw Publishing Company three years later. For six years he acted in the capacity of business manager of "Electrochemical Industry" (now Metallurgical and Chemical Engineering), after which he was transferred to the Chicago office of the McGraw Publishing Company, as western manager for "Electrical World." For the past three years he has represented the McGraw publications on the Pacific Coast, and has a wide acquaintance among central station men, manufacturers and dealers. The Society is now well represented in all parts of the country, and the recent appointment will insure personal coast representation for the society in connection with the big "Electrical Prosperity Week" campaign.

A recent fire destroyed considerable quantities of municipal electric supplies, which had been purchased for the construction of Renfrew's White Way lighting system.

Electrical Co-Operation—in Fact—and Fancy

[From a member of The Electrical Dealers' and Contractors' Section of The Retail Merchants' Association of Canada, Incorporated, regarding an article under the above caption appearing in the June 1 issue of "Electrical News," page 38. This article deplored the existence of two organizations, and emphasized the necessity of co-operation—in fact—if the greatest good is to result. The writer of this article in his concluding paragraph also strongly emphasizes this point.—Ed.]

Before entering into a discussion of the different phases of this question, touched on in the article referred to, it would be well to get the subject matter clearly before us. We find that there has been in existence for some years past in Toronto, an organization known as "The Electrical Contractors' Association of Toronto." The organization of this body was, we believe, the outcome of the urgent need that was even then apparent to the trade for "Electrical Co-operation—in fact," and the establishing of that unity of interest which is so necessary to raise the trade to a higher plane, and to resist the many injustices which were threatening to engulf us. Being the first established association in the field, we acknowledge that they were entitled to the first consideration of every dealer and contractor so long as they retained as the firm foundation of their organization the true spirit of "co-operation." We believe that the cordial support of every legitimate contractor was ready at hand.

In endowing the association with our support, we impose upon them certain responsibilities to us. Let us now look into the manner in which they have fulfilled their responsibilities. We find: First—That in spite of the fact that they have had the field to themselves for the past few years, they are still very weak in numbers, and that a large majority of the trade are still outside the fold; Second—Instead of their effecting an improvement in conditions affecting the trade, we know that our difficulties have been greatly augmented, and that operating conditions today are worse than ever before; and Third—In looking for that spirit of true co-operation and good-fellowship which we had hoped the association would engender, we find the trade imbued with a certain feeling of antagonism to, or distrust of any organization along these lines.

The numerical weakness of the association is due to the fact that no concerted effort has been made to recruit members either in the city or throughout the province, and that they have failed to gain the confidence of the trade at large. In no case have the aims and objects of the association been clearly placed before the trade, and when we find that reputable contractors of good standing in the community have been refused membership, we can only conclude that their desire is for an exclusive membership, and that they have not the general welfare of the trade at heart. The only occasions on which they solocited the attendance of a representative body of the trade at their meetings were when they wished to gather strength to oppose objectionable legislation. The individual members of the trade now seem to have reached the conclusion that their support was only desired at times when they could be of service to the ruling elements of the association.

The new association, "The Electrical Dealers' and Contractors' Section" of "The Retail Merchants' Association of Canada, Incorporated," while still in its infancy, boasts a membership of nearly five times that of the older body. An energetic and enthusiastic Organization Committee has been appointed, who are devoting considerable time to active campaigning for members each week, while every member of the association feels himself an honorary member of the Organization Committee, and is pledged to bring a new member to each meeting until the trade is thoroughly organized. A strong campaign has been inaugurated through the parent organization, "The Retail Merchants' Association of Canada," to organize the scattered branches of the trade throughout the province. Several bumper meetings have been held in the association rooms, over the Bank of Commerce, corner Yonge and College Streets, and each meeting has been larger and better than the last, and we welcome every member of the trade to attend the meetings and take part in the discussion. Our meetings are at present open to non-members as well as members.

We have had nothing but encouraging success from the outset, and believe, with a large and representative membership, that we can effect many much-needed improvements in conditions as they exist today. Even now our membership roll speaks for itself, embracing as it does some of the biggest men in the field.

We are not in any way antagonistic to "The Electrical Contractors' Association," and have every desire to work in harmony with them. We would like to have every one of them members of our Section. In this article we are simply defending the organization of the second association (something which needs no defense with a large majority of the trade), and the deficiencies which we point out as existing in the first organization are mentioned in a spirit of perfectly good-fellowship, to make plain to them our reasons for withdrawing our support, and this reply is written because we wish to put our statement of the case fully before every member of the trade throughout the province.

Our reasons for affiliating ourselves with "The Retail Merchants' Association of Canada, Incorporated," are obvious, and may be stated briefly as follows:—

First:—We united with or became a part of "The Retail Merchants' Association of Canada, Incorporated," so as to be better able to take care of our Retail Class interests to which we belong, and to have a voice and a vote in directing its policy, and by the addition of our members to help to add to, and increase an organization that has for some years been defending the rights of the Retail Class, and which could not have been done by any other organization.

Second:—By being a Section, and adding our numbers, we become allies, and our collective and numerical strength will secure for us better commercial laws, and enable us to oppose injurious ones.

Third:—By being a Section, and becoming united as one large and important body of Retail Merchants, we become recognized as expressing the official voice of the great retail distributing force of Canada, and we stand ready at all times to defend ourselves against any unfair public criticism, or any injustice that may be imposed upon us. As a single line association we recognize that we would be helpless.

Fourth:—By becoming a Section of "The Retail Merchants' Association of Canada, Incorporated," we have permanent and well-equipped premises with trained officers, organizers, and an excellent office staff and equipment. We have our own meetings, and our own officers, and we enjoy local home government, with all the advantages of the larger organization to assist us when necessary. In fact, anyone who objects to our organization plan would find fault with the plan upon which Canada or the British Empire is founded.

Fifth:—Last, but not least, we know for a certainty that we can accomplish more for the benefit of our trade in addition to some of the other advantages mentioned, and at a less cost than can be done in any other way, or by any other body, and for these reasons, as well as many others that space will not permit us to mention, we know that we made no mistake either in "Fact" or "Fancy" when we made our decision.

With the difficulties that are now confronting us in every branch of the trade, and the necessity for taking steps to extricate ourselves from our present position, we deeply de-

plore any controversy of this nature. The best efforts of everyone interested should be devoted toward the alignment of our fighting strength to the end that we may present a solid front to the forces that are now making serious inroads on our earnings, and which threaten to overwhelm us. Our sincere hope is that the rival association will give us the privilege of meeting them, to lay our plans of campaign before them, and by a frank discussion, to clear up the present differences. If we cannot then merge into one strong body, at least let us hope that we can form a coalition to carry on the fight for the common good.

Let us "keep our eyes on the battle front," and if sacrifices are necessary to gain unity of action, let us all be prepared to make the necessary sacrifices.

Moved to Larger Premises

About eight years ago, the Devoe Electric Switch Company, Mr. R. Moncel, manager, commenced business in a very modest way in Montreal; the trade has now grown to such an extent that recently it was imperative to remove to much larger premises at 414 Notre Dame Street West. This is a building of eight storeys, with the offices on the ground floor, the remaining portion being devoted to the manufacture of the company's goods. New machinery has been installed, and the offices and factory equipped to give prompt despatch of orders. The company specialize on four electrical productions, switches, panel boards, switchboards, and steel boxes and trims, which are produced in many types. It is claimed that by specializing on these four articles, goods of the highest quality are produced. About 2,000 switches of standard types and 1,500 steel boxes are carried in stock.

The company have just issued a new catalogue of 90 pages, illustrating many of the switches, panel and switchboards, boxes and accessories manufactured. The information is complete, and gives a good idea of the wide range of the types sold. Particular stress may be laid on the Type C Switches, made of pure copper, from 30 to 200 amp. front connected only. One of the features of the catalogue is a comprehensive telegraphic code.

Wiring of Existing Buildings

At the recent Convention of the National Electric Light Association in San Francisco, Mr. R. S. Hale, Chairman of the Committee on the Wiring of Existing Buildings, made extended reference to the subject of standardizing plugs and receptacles, wiring costs, the N. E. L. A. hand-book, standardization of screw threads for lamp bases, the National Code, bare concentric wiring and flat-wiring rates. It was suggested that inspectors ought not to discourage the use of receptacles by requiring separate circuit switches and pilot lamps to be installed where receptacles are used. It was stated that the American Society of Mechanical Engineers had adopted standardization of screw threads for lamp bases, with minor changes, as already in use by Class D members of the association.

With reference to concentric wiring the committee has decided to continue their investigations and to make a study of trial installations so that they may base their recommendations on practical experience. The committee expressed themselves in favor of the unit-price system of wiring, which enables the central station salesmen to close contracts for both wiring and service. They did not recommend any attempt to establish standards because wiring costs naturally vary with locality and conditions.

In the discussion which followed, Mr. S. E. Doane, of the New York Lamp Works, mentioned the difficulty encountered in getting manufacturers to agree on any standard type of plug or receptacle. Mr. Sargent, of the General Electric Company, stated that his company was prepared to meet the demand of the central stations so far as the supply of concentric wire was concerned, but they are not trying to force this wiring upon them. The General Electric Company are manufacturing tools and dies for fittings whereby concentric wiring can be installed easily. Mr. Sargent expressed the opinion that progress would be made during the next year towards universal plug standardization. Other speakers expressed the opinion that concentric wiring was one of the most important questions confronting the contractor at the present time. It is difficult to serve the small consumer unless his wiring can be installed at a very low price. If concentric wiring will save expense and meet the demands of safety it will be welcomed by contractors. The inclusion of the small consumer is as important to the central station as to the contractor.

Have Opened New Offices

The National Metal Molding Company, manufacturers of electrical conduits and fittings, Pittsburgh, with offices in various cities, have recently opened offices at 801-802 Electric Building, Buffalo, from which to handle their increasing business in Western New York and Canada. This office will be under the charge of Mr. L. S. Montgomery, who has represented the company in the South and other sections for a number of years, and is especially well-known in the electrical trade. Mr. Montgomery is a prominent and active Jovian, and was Apollo in the Eleventh Jovian Congress.

Trade is Brisk

While the electrical business generally is on the quiet side, the Fred Thomson Company, Limited, Craig Street West, Montreal, manufacturers and dealers in motors, report that their trade is very brisk. The firm have recently sold over thirty motors to one company, and have also received a contract from Curtis's and Harvey, Canada, Limited, Montreal, explosives manufacturers, for the supply of several motors and other electrical equipment, to be installed at Rigaud, P.Q.

The Gananoque Electric Light and Power Supply Company have been given authority to increase their capital from $40,000 to $100,000. Their powers are also extended to allow them to export and import power to and from the United States, and to develop water powers in the counties of Leeds and Frontenac.

The Universal Iron & Supply Company, 325 Locust Street, St. Louis, Mo., have issued a little folder describing their Storage Tanks for Railway Cars. These tanks vary in capacity from 1,000 to 8,000 gallons, and in dimensions from 72 in. x 20 ft. to 76 in. x 32 ft.

G. N. Clarke & Company have opened offices at 525 Board of Trade Building, Montreal, as electrical jobbers and manufacturers' agents. Mr. G. N. Clarke, formerly of Roper, Clarke & Company, Limited, is the manager.

Electrical Testing Laboratories, Inc., New York City, are distributing copies of their latest loose-leaf catalogue, describing the equipment, organization and work of these laboratories. The catalogue is very fully illustrated.

Messrs. S. D. Sweetman and A. A. Giddings have registered as electrical engineers in Montreal.

The Shipton Electric Light Company have started work on the construction of their new concrete power dam.

The Imperial Electric Company have registered in Montreal, P. Q., as electrical contractors.

A Rapidly Developing Business

In these days of war and strict economy, most manufacturers, outside of those catering to the supply of munitions, are content if they can "mark time" without retiring. There are occasional exceptions, however, and we are pleased to record another of these in the electrical trade—the Renfrew Electric Manufacturing Company, Limited, of Renfrew, Ont.—whose working staff this year is approximately double what it was a year ago. A brief review of the history of this vigorous company will be of interest to our readers.

During the summer of 1913 the modern factory of the Renfrew Electric Manufacturing Company, Limited, as shown herewith, was erected for the manufacture of electric heating appliances. Prior to this experts had been working on new designs for the different lines which were to be manufactured consisting of electric irons, toasters, grills, disk stoves, radiators, etc., and the line when introduced, now so widely and favorably known throughout the Dominion, was

Mr. C. E. Breckenridge.

named the Canadian Beauty, applicable to the complete list of electric heating appliances.

During the first two years the sales organization was conducted by the company's manager, Mr. Chas. E. Breckenridge, and during that time a steady and growing business has been enjoyed by the company in the face of conditions which have forced many stronger and older companies to withdraw from certain of their fields and reduce their staff. Latterly the general oversight of manufacturing, financing, salesmanship, etc., has become too heavy for Mr. Breckenridge, who found it necessary, early in the present summer, to get assistance in the handling of his sales organization. As already announced in the Electrical News, Mr. B. E. Rowley has, since early in May, occupied the position of Sales Manager of this company.

Mr. Rowley probably needs as little introduction to the Canadian trade as anyone handling electrical goods. He has been identified with the Hot Point Electric Heating Company in both the United States and Canada for a great many years, and the Canadian Beauty line may take it as a compliment that Mr. Rowley should choose to cast in his lot with this growing company. The sales organization of the Renfrew company is now conducted in that vigorous manner which has characterized Mr. Rowley's efforts in the past. During the spring months of the present year a sales campaign was conducted by this firm advertised as the "Canadian Beauty Fortnight." This campaign met with marked success. The advertising features were well thought out

Factory of Renfrew Electric Mfg. Co., Renfrew, Ont.

and carried out, and dealers all over the Dominion have reason to be gratified with the vigorous plan of campaign of the sales manager of the Canadian Beauty line.

No small share of the success of this company is due to the fact that their factory equipment is up to date in every respect. They have all the necessary departments for building the articles from raw materials, thus using Canadian labor throughout in their up-to-date moulding shop, grinding room, polishing room, nickel plating, copper oxidizing, buffing room, assembling and testing department, the mach-

Mr. B. E. Rowley.

ine shop, tool and stores department. We understand that the present growth of the business has made it necessary for the management to consider the construction of a new office and stores room, so as to allow more space in the main building for manufacturing. A number of illustrations of the goods manufactured by this firm will be seen in their announcement on another page of this issue.

What is New in Electrical Equipment

New Factory of W. H. Banfield & Son

We illustrate herewith the new head office and factory building of W. H. Banfield & Son, situated at 370-386 Pape Avenue, Toronto. This factory will be used in part, temporarily, for the manufacture of high explosive shells and component parts for shrapnel shells and various other war munitions, and in this connection no expense has been spared in the installation of the most up-to-date equipment. Over 250 men are employed day and night. An important feature in connection with this new plant is a commodious and comfortable restaurant for the use of the employees. This company will, of course, continue the manufacture of their regular lines of electric brass goods, and will maintain their city sales office and show rooms at 120 Adelaide Street West. This will be under the management of Mr. W. J. Young. The rapid expansion of this company's business would indicate that by the time the war is over and the manufacture of war munitions is no longer necessary, the increased demands for their regular lines will utilize the full capacity of their new factory.

New Banfield Factory on Pape Ave., Toronto.

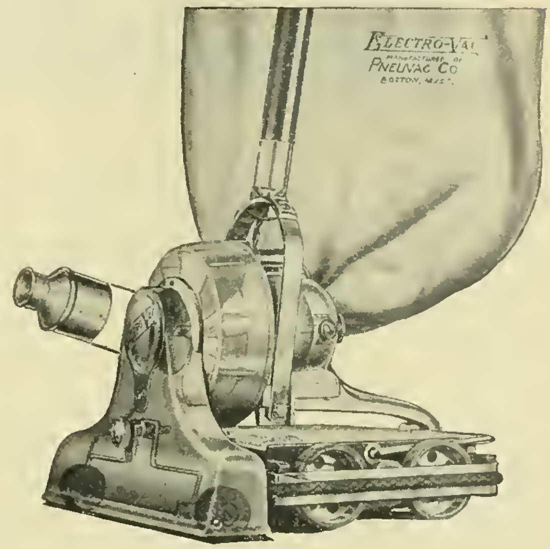
Extension Attachments for Pull Sockets and Rosette Pull Switches

The use of pull-chain sockets with shades or reflectors of large diameter imposes a severe strain on the shade-holder because of the side pull of the chain or cord. This soon produces a dilapidated condition of the fixture unless the shade-holders are frequently readjusted. To overcome this difficulty, the Arrow Electric Company, Hartford, Conn., has added to its entire Arrow E line of pull sockets and rosette pull switches extension attachments which bring the cord out a considerable distance from the axis. As shown in the accompanying illustration, the extensions are securely attached to the body of the device.

Extension attachment installed.

New "Electro-Vac" Suction Sweeper

This new sweeper, recently placed on the market by The Pneuvac Company, Boston, Mass., is a combination carpet sweeper and suction sweeper. The outfit consists of the old type carpet sweeper for gathering lint, threads, etc., over the top of which a vacuum cleaner is mounted. The nozzle of the vacuum cleaner precedes the carpet sweeper as it is pushed forward. The outfit is so constructed that the suction cleaner and carpet sweeper can be used together or separately as desired. A separate handle is provided for the carpet sweeper to be used when the sweeper is operated separately. This gives a three-in-one machine, an ordinary carpet sweeper or suction sweeper or a combination of the two.



Electro-Vac driven by Robbins & Myers motor.

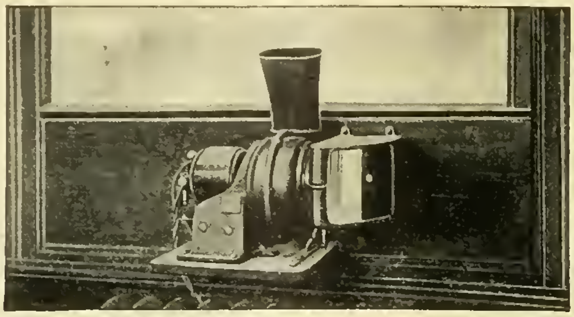
The weight of the suction member is $9\frac{1}{2}$ pounds and the carpet sweeper weighs 3 pounds. The machine is $8\frac{1}{8}$ inches high. The suction cleaner has a 12-inch nozzle with adjustment for height and has an 8-bladed fan. The motor is supported above the sweeper in a horizontal position. Hose connection is made to the machine for cleaning draperies, curtains, etc., by pushing aside the sliding cap at the front of the machine and attaching the hose connection.

Hygienic Ventilation

The Chicago Ventilation Commission some years ago came to the conclusion that ventilation with cold outdoor air was impractical owing to the tendency of very cold air to resist diffusion with the warmer air of the room. The air warmed by the radiators went to the ceiling, while the cold air fell to the floor. The Gerdes ventilator, manufactured by Gerdes & Company, 30 Church Street, New York, overcomes this difficulty in two ways: by blowing the cold air to the ceiling with sufficient velocity to cause it to creep along the ceiling until it falls away in all parts of the room, and, when the weather is very cold out of doors (below 25 degrees F.) by mechanically mixing enough warm air from the room with the cold air to bring the temperature of the mixture to a normal coolness (about 30 degrees F.). The result is that a uniform temperature exists from floor to ceiling and absolutely no draughts are felt; in fact, it is impossible to feel that cold air is coming into the room.

The ventilator consists of a Westinghouse Sirocco blow-

er, together with a combined duct and mixing chamber for bringing outdoor air or indoor air to the blower, or a mixture of the two sufficient to maintain a comfortable atmosphere in the room. When the slide in the duct is brought forward and the duct closed to the room, the blower draws only cold outdoor air; when it is pushed back the cold air is cut off and air from the room is re-circulated; when the duct is partly open to the room, see figure, the slide closes the opening to outdoors by the same amount and streams of

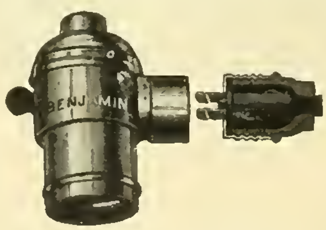


Mixes air in any desired proportion.

cold outdoor air and warm indoor air mix in the blower. By adjusting the slide any temperature can be had at the nozzle between that existing indoors and out. The cool mixture being blown to the ceiling, spreads out against it, and, after losing its momentum, gradually sinks through the warm room air and is breathed before it passes to the radiators.

A Current-Tap Socket

Not infrequently there is placed on the market an article that seems to fill a vacant niche and whose convenience is so apparent at first glance that one wonders why it was not thought of before. The idea of the current tap is old; this was one of the earliest of electrical devices. The socket, too, runs back almost beyond memory. A combination of the two would appear to be desirable. The Benjamin Electric Manufacturing Company of Canada, Limited, Toronto, have perfected this type of socket, and now offer for sale the article shown in the accompanying illustration. Primarily the device is a fixture socket, and the manufacturer has tried to avoid a marked departure from the accepted type of brass-



New Benjamin Socket.

shell socket. The main difference appears in the addition of a housing for the plug attachment, which is small and neat, and does not detract. The capacity of the plug attachment is sufficient for the purpose of operating any ordinary portable electric device. Control of the socket is by a lever of insulating material, which in the multiple form controls the operation of the lamp, and in the series form gives either series connection, or cuts out the plug, allowing the lamp to burn at full brightness. This socket should prove an attractive proposition for general household use, wherever it is desired to operate small electrical appliances from a socket without removing the lamp or doing without a light.

The British Columbia Telephone Company contemplate extensions to cost some $70,000.

Hubbell flush wall receptacle

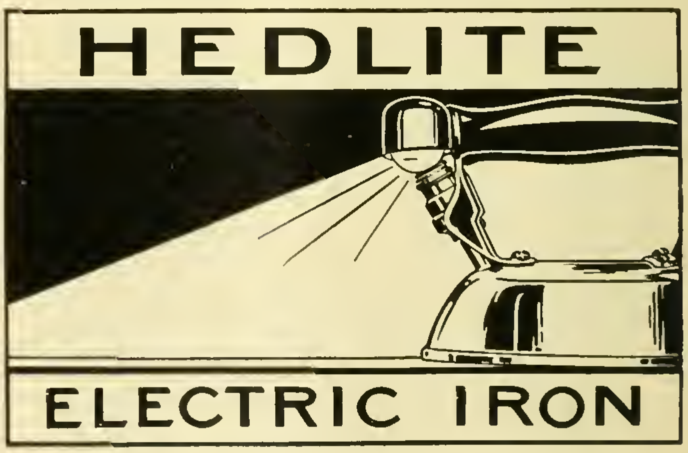
Harvey Hubbell, Inc., Bridgeport, Conn., have placed on the market a new type of flush wall receptacle equipped with the new T-shaped slots. This type of slot receives interchangeably the seventeen different kinds of Hubbell prong-type caps for attachment plugs, etc. The receptacle is of the lift-cover type and has a perfectly flush surface when not in use. A special hinge construction slightly projects

Flush receptacle with cover raised.

the base of the cover when open, permitting it to fall back at an angle against the plate. This arrangement makes it impossible for the cover to drop down through unintentional jar and thus eliminates an annoyance commonly met with in the lift-cover design.

Electrically Illuminated Iron

An electric iron with a small tungsten lamp mounted in front of its handle is shown in the accompanying illustration. On account of the position of the lamp the iron has been named the "Hedlite" iron. Use is made of a 4 c.p., 6-volt round-bulb tungsten lamp, but this tiny unit, on account of its proximity to the ironing board, gives more light on the board directly in front of the iron than would be obtained from several large lamps in a ceiling fixture. The lamp is provided with a metal reflector which is about as large in diameter as the handle against which it fits. The

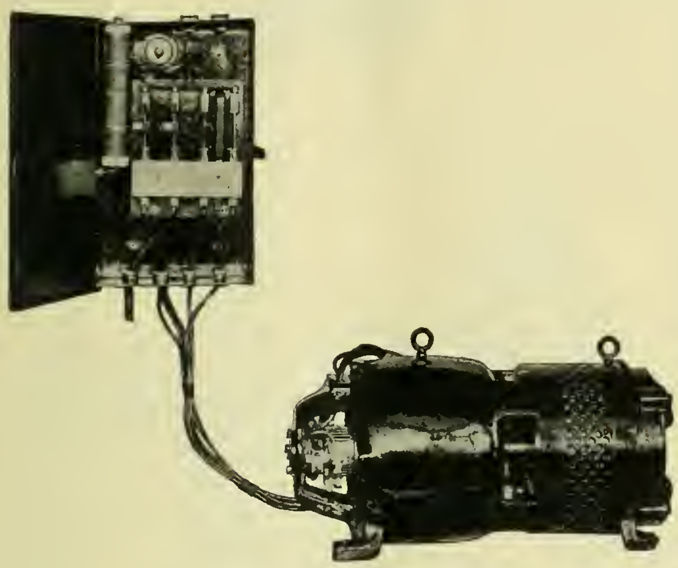


reflector acts as a shield to keep the light from striking the eyes when the iron is in operating position. The lamp socket is supported by the front handle bracket, and the supply wires for the lamp are carried through a metal tube to the interior of the iron. The lamp burns whenever energy flows through the iron and thus incidentally serves as a pilot lamp. An iron thus equipped is especially desirable where there is only one outlet, as is frequently the case in apartments and small dwellings. The lamp and iron together take 500 watts. The iron is made in both tilting and non-tilting types and is being placed on the market by the Pittsburgh Electric Specialties Company, Pittsburgh, Pa.

The Lincoln Electric Charger

The advantages of keeping the electric car in the owner's garage, where it is readily accessible, is becoming rapidly recognized. The chief difficulty heretofore has been the matter of charging, it being difficult to secure a charger which would fully charge the battery and yet do it in a manner which would demand little attention, would be efficient and with no chance of injuring the batteries. To meet this increasing demand, the Lincoln Electric Company of Cleveland, Ohio, have developed the Lincoln electric charger.

This is a small motor-generator set complete with wall panel, as shown in the illustration. The set consists of a single-phase alternating current squirrel cage motor, direct-connected to a compound-wound interpole direct current generator, the armature of the generator and the rotor of the motor being mounted on one shaft, thus making a two-bearing set. SKF ball bearings are used, which eliminates any possibility of bearing trouble. The motor is non-self-starting and depends upon the direct current generator acting as a motor and taking power from the batteries to start the set. This is all taken care of by the starting switch. The mode of procedure in charging the car being as follows:

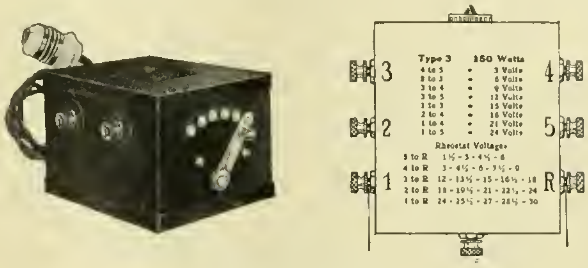


"Electric" charger for home garage.

The plug is first placed in the car, then the switch thrown in as far as possible. Special arrangement keeps the switch from closing the alternating current circuit. Three clips are engaged, one of which short circuits the series field and the others throw the batteries across the shunt field and the armature of the direct current end. The set comes up to speed, then the switch is drawn back as far as possible and then thrown entirely in. This throws in the alternating current and removes the short circuit across the series field of the generator and the direct current end acting as a compound wound generator, starts to charge the battery. It is impossible to throw the switch in wrong as an automatic arrangement prevents it. It is thrown in as far as possible and drawn back as far as possible and then thrown entirely in. The advantages claimed for this outfit are low first cost, extreme simplicity, very low battery depreciation and the tapering charge which is given automatically by the use of the charger.

Improved Line of Toy Transformers

The Jefferson Electric Manufacturing Company, Chicago, have recently placed on the market an improved line of flexible toy transformers. The flexible features consist of a regulating switch and master connection post, by means of which a range of voltages from zero to the maximum voltage is available in small and uniform steps. The incorporation of a regulating switch and master connection post results in a wide range of low voltages for operating and regulating the speed of electric engines, small motors, electric trains, etc. The transformers are made in three sizes: 50 watt, generating ten secondary voltages from 1½ to 15 in 1½ volt steps; 75 watt, generating sixteen secondary voltages from 1½ to 24 in 1½ volt steps; and 150 watt, generating twenty secondary voltages from 1½ to 30 in 1½ volt steps. The diagram herewith shows range of voltages obtainable from 150 watt size.

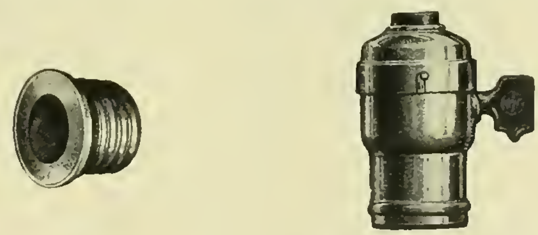


Ranges from 1½ to 30 volts.

New Wiring Devices

Two new C. G. E. electrical fittings possessing novel features have just been placed on the market. The first is a fuse plug built up of fibre, mica and brass, and the second a locatable cap socket. Unlike the older forms of fuse plugs this one contains no porcelain at all, which reduces its weight to less than half of that of the porcelain plug. It has an air space 50 per cent. larger than that of the porcelain plug, ensuring correct rating and blowing. Best of all, it is non-breakable. There is nothing fragile about it.

The socket is rated at 660 watts at 250 volts. The make and break is quick in action, a pointed key indicating whether the current is off or on. The cap is slipped off by depressing the shell near the boss, and then turning the cap to the right to allow the pin to slip out of the L-shaped groove in the cap. Another feature of special interest to fixture dealers is the narrow groove in the neck of the cap, the object of which is to allow the top to be turned through a wide angle even after it is firmly threaded on the nipple. The additional turning merely closes the mechanical groove. A special key for this work is supplied on request.



Fibre plug and locatable socket.

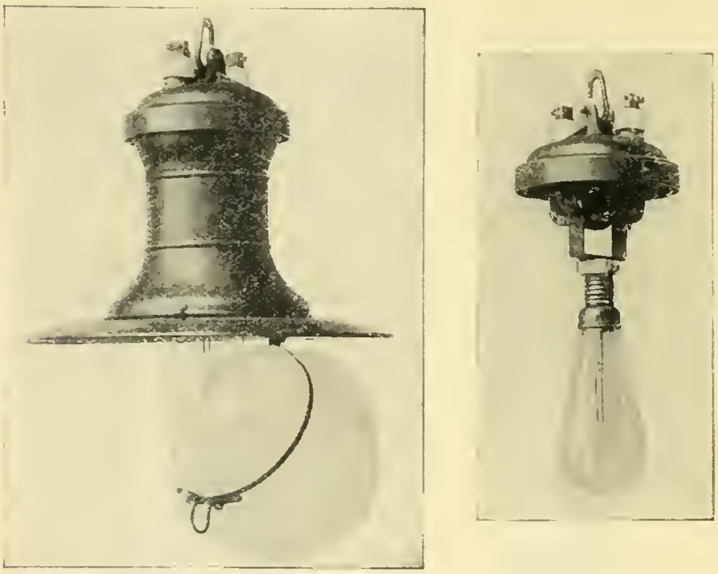
Street Lighting Fixtures for Mazda "C" Lamps

With the development of the Mazda "C" lamps for high candle power, specially designed fixtures are required to successfully utilize these lamps for the severe conditions of street lighting service. The life of the lamp and the efficiency of the complete unit are vitally affected by the globe shape, ventilation and weatherproof qualities of the fixture. Inasmuch as the lamp renewal cost per year for each fixture greatly exceeds the first cost of the complete fixture, any construction increasing the life of lamp is of prime importance, and no make-shift device should, from an economical standpoint, be considered for installation with these comparatively expensive lamps.

Of first importance in the design of any fixture for this

service is the ventilation given to the lamp, as the heat radiated from lamps of this type is comparatively intense. Without ample ventilation, the life of the lamp will be very seriously curtailed. By careful experiment over a considerable period of time, the Westinghouse Electric & Manufacturing Company have determined the proper arrangement to give the maximum ventilation, and at the same time provide a weatherproof unit and enable the proper screening of all openings to exclude insects. The exclusion of insects has always been an important requirement with street lighting fixtures, but one that has been infrequently fulfilled. As the fixtures are hung in comparatively inaccessible places the frequency of necessary visits should be cut down as much as possible, and this can only be done by such a design. The high operating temperature of the Mazda "C" lamp necessitates its careful protection from rain and snow. Consequently, the ventilation must be so arranged that the lamp is not in danger from this standpoint.

The appearance of a street lighting unit is always of importance, inasmuch as it occupies perhaps the most conspicuous position of any piece of electrical apparatus. The unit shown here is of symmetrical appearance, both when equipped with reflector and when used without the reflector. A 20-in. reflector of the concentric type gives the fixture



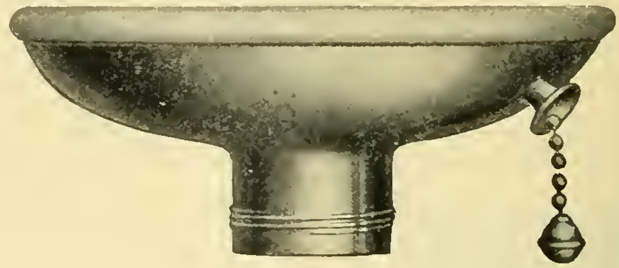
Fixtures for Mazda "C" lamps.

the most finished appearance. The globe is of acorn shape, designed to utilize the light to the best efficiency. A diffusing globe is recommended on account of the high intrinsic brilliancy of the lamp, and because of its suitability for good street lighting requiring minimum glare. The fixture is specially constructed with a view to maximum durability and accessibility. The case is of solid copper, finished in black enamel. The leading-out wires are brought to binding posts of neat, convenient and durable construction. The globe is hinged at one side, and latched at the other. This readily enables the replacement of lamps.

This fixture is primarily designed for use with the high current lamps, and is equipped with a core type auto-transformer to enable their use on existing 6.6 and 7.5 ampere constant current a.c. circuits. The 15 and 20 ampere Mazda "C" lamp has a very much higher efficiency than the lower current 6.6 and 7.5 ampere lamp. Even considering the losses in the auto-transformer, it is claimed that the energy saving at 1c. per kw.-hour on a 1,000 hour per year schedule is sufficient to cause a saving equivalent to the additional first cost of the auto-transformer within eighteen months. At the same time, the use of the auto-transformer eliminates the necessity for a film cut-out socket, inasmuch as the open circuit voltage of the secondary of the auto-transformers amounts to only two or three times the lamp volts and the auto-transformer is not injured by continuous operation on an open circuit.

Bryant Ceiling Receptacle

The Bryant Electric Company of Bridgeport, Conn., have brought out a new ceiling and wall receptacle with pull chain for concealed wiring, designated as their catalog No. 4104. This is designed especially for a 4-in. outlet box, but may be attached also to 3¼-in. boxes. In addition it can



be used for ordinary ceiling work because of its perfectly flat back. This device measures 4⅝ in. outside by only 2 in. deep. Holes for supporting screws are spaced on 3½ in. and 2¾ in. centres. Binding screws are provided to which "loop" wires may be readily attached.

Pagrip Metal Moulding and Fittings Therefor

A new type of metal moulding of unique construction and with a complete line of appropriate fittings therefor has been developed and placed on the market. This type of moulding has been given the trade name of Pagrip. In the design of this material it was aimed to secure a very simple but rigid and durable construction, and one that would permit easy installation and ready adaptation to standard fixtures.

A fair idea of the construction of this moulding is obtainable from Fig. 1, which shows a short piece with the relative position of capping and wires made clear. The other cuts show fittings for use with this moulding. The body of the moulding is an open-top channel with an internal width of 25/32 inch and a depth of 9/32 inch. The upper portion of the channel has its sides brought together and curved upward, leaving a narrow opening for the reception of the capping. The latter is also in channel form, with the edges flanged outward. This capping can be readily inserted in the open top of the base, after the wires have been placed in the moulding, by merely pressing the capping in until the flanged edges of the capping engage the edges of the base. Both the base and cap are made of spring steel so that the cap is gripped in place and rigidly held. Should it be necessary to remove the capping again, it can be done by applying sufficient pull. After the capping has been put on, the moulding has a neat, finished appearance, its grooved face giving the aspect of a simple ornamental moulding.

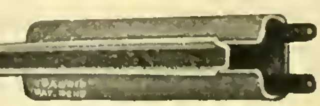


Fig. 1.

Joints of adjacent sections of moulding are formed by merely slipping together adjoining ends, the elasticity of the sides permitting a good mechanical and electrical joint to be made; no screw connection is required. This method of forming joints results, it is claimed, in a saving of 25 per cent. in installation cost, since only one man is required to install the moulding, wires and fittings in perfect condition, regardless of the length of run. As soon as the base is mounted on the ceiling or walls by means of a simple type

of clip, the wire can be laid into the channel and a cover put on in very short time.

In tests of this moulding it was found that a pull of about 30 pounds was required to open the joints. Current was also applied to a run of some 20 feet of moulding in which were inserted a large number of fittings, making a total of 27 joints, the idea being to see whether the material itself afforded a good path for grounding of the moulding. Although a current of 15 amperes was applied, after two hours no appreciable temperature rise was noticeable at any joint. In handling the entire run of moulding with fittings referred to, the entire arrangement showed a strength and rigidity about equal to that of a solid piece of moulding, no loosening or buckling of joints being noted.

In the line of fittings that has been developed for use with this moulding there has been designed a complete assortment, of which the accompanying illustrations give an idea. In the case of elbows, tees, crosses, etc., Fig. 2, the connecting ends are C-shaped in cross section. These ends telescope over the end of the moulding base a distance of 1.125 inches, a small lug or stop being provided near the end of the moulding for this purpose. This lug fits into the rectangular pocket shown in the connecting ends of the fittings, thus locking the joint securely. The caps for the fittings fit over the extension and are held in place by spring

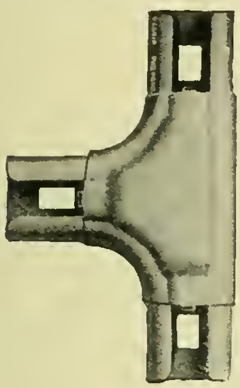


Fig. 2.

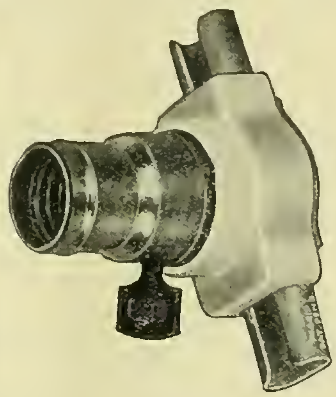


Fig. 3.

action. A tongue on the cap fits into the groove in the capping of the moulding.

Among the fittings is an ingenious junction-box base, which can be used with appropriate covers as a plain junction box, as an outlet for drop cord, as a fixture base for mounting snap switches, rosettes, etc. A large fixture box, can be used with the moulding for any standard four-inch canopy, blank or fixture covers. When used for mounting snap switches, fixture sockets or receptacles, another type of cover with slots for two screws is used. Fig. 3 shows a receptacle standard key or keyless type mounted on the base; this can be used in connection with one-way or two-way fittings. All of the various boxes and covers are provided with lateral knockouts, so as to fit the conditions. A very simple form of connector is used for joining a straight run of moulding to any standard box. The lateral knockout is broken away and the connector slipped on from below, so that the notches engage the sides of the opening in the box. This type of moulding and the fittings for it have been approved by the Underwriters' Laboratories, Incorporated.

This equipment was formerly manufactured by the Pagrip Metal Molding & Fitting Company, but this company's patents have recently been purchased by the Appleton Electric Company, Chicago, who will in future control the sale of this new line.

It is understood that the Sarnia City Council will make an offer to the Sarnia Gas and Electric Light Company of $155,000 for their plant and equipment.

Trade Publications

Motor Generator Sets—Bulletin No. 42552, by the Canadian General Electric Company, describing, with illustrations, motor-generator sets of all sizes, including battery charging sets as small as 1/8 kw.

Electrical Instruments.—A set of condensed bulletin sheets, covering their various lines of instruments, circuit-breakers and watthour meters, is being distributed by the Roller-Smith Company, 203 Broadway, New York.

Starting Switches.—Re-issue of Bulletin B24 by the Allen-Bradley Company, Milwaukee, describing their type 11 resistance starting switch for a. c. induction motors. This bulletin has been greatly improved and enlarged over the previous issue.

Mining Machinery.—The R. D. Nuttall Company, Pittsburgh, Pa., has issued Catalogue No. 12 on Mine and Industrial Gears, Pinions and Trolleys. This publication covers mine haulage locomotive gears, pinions and trolleys, mining machine gearing, mine haulage and general data for ordering industrial gears.

Generator Sets.—Bulletin 20, issued by the Universal Motor Company, Oshkosh, Wis., describing their 3 kw. Universal Direct Connected Generator Set. The Bulletin illustrates and describes the various uses to which this equipment may be put, including house and store lighting, battery charging, boat lighting, moving-picture work, search-lights, wireless telegraphy, pumping, etc.

Electric Railway Equipment.—The R. D. Nuttall Company, Pittsburgh, Pa., has issued Catalogue No. 13 covering electric railway gears, pinions and trolleys. This publication gives general data on Nuttall railway motor gearing for Westinghouse and General Electric Equipments, Nuttall trolleys, harps and wheels, flexible couplings of the spring and buffer type, and electric railway compressor gears.

P. & S. Equipment.—Pass & Seymour, Inc., Solvay, N.Y., are distributing three interesting booklets describing certain of their newest equipment. One of these illustrates the "Uno" shade holder, which is so easy to attach to the socket, and into which the shade or reflector can be so easily inserted. A second pumphlet deals with P. & S. decorative material, describing many of the numerous devices of this company which make decorative illumination easy to install. The third pamphlet illustrates Mogul sockets and receptacles.

Monel Metal—An interesting booklet issued by the International Nickel Company, describing some of the most important physical and chemical properties of Monel metal. This is a natural alloy of approximately 67 per cent. nickel, 28 per cent. copper, and 5 per cent. other metals. Monel metal has a melting point of 1360 deg. Cent., and a specific gravity of 8.87. Its electric conductivity is approximately 1/25, and its heat conductivity is approximately 1/15, that of copper. An important property is that it does not corrode. Monel metal is manufactured in a great variety of forms and is used for a great variety of purposes, all of which are described in this publication.

The Department of the Interior, Ottawa, Water Power Branch, are distributing water resources No. 8, which covers the British Columbia Hydrographic Survey for the calendar year 1913. The report is by R. G. Swan, chief engineer of this department, and has been prepared under the direction of the superintendent of the Water Power Branch, Mr. J. B. Challies.

The shareholders of the Camaguey Company, Limited, have given a ninety-day option on their property to the Electric Bond and Share Company of New York, at a price of $50 per share. The property of the power company includes a lighting and tramway business in the island of Cuba.

Current News and Notes

Brockville, Ont.

The City Council has passed a by-law authorizing the issue of debentures to the extent of $6,000 to be used for the extension of the hydro-electric system, to supply residents on the water front, and others, with light and power.

Calgary, Alta.

The deficit of the street railway net receipts for May has been reduced to $163.31, after all charges are paid. The gross revenue was $45,745, as against $61,596 in 1914, but this reduction in receipts is offset by a large reduction in operating expenses. With this favorable showing it is expected that the near future will see the Calgary Street Railway System balance again on the right side.

It is reported that a New York Syndicate are negotiating for the purchase of the property of the Calgary Power Company. This property is valued at approximately $3,000,000.

The City Council of the city of Calgary have voted funds for the preparation of a booklet which will deal with water power possibilities in the vicinity of Calgary. This booklet is to be distributed widely at the San Francisco Exposition.

Dorchester, Ont.

The by-law has been carried and it is reported work will be commenced on an electric distributing plant to cost some $35,000.

Elora, Ont.

The Organ Power Company, Hartford, Conn., recently installed an electric organ blower in Knox Church, Elora. The motor is a ¾ h.p. Century.

Hamilton, Ont.

Engineer E. I. Sifton has recommended the purchase of a duplicate set of transformers for the east-end sub-station.

The Wentworth County Council are considering the installation of electric lights on Stoney Creek Road from the city limits of Hamilton to Red Hill, near Stoney Creek.

A special committee of the City Council has been appointed to prepare a by-law regulating the jitneys.

A report recently submitted to the Hamilton hydro department shows that there are at present 11,061 customers of Niagara power.

Kelowna, B. C.

It is reported that DuCane, Dutcher & Company, 470 Granville Street, Vancouver, are preparing plans for a hydro-electric plant on Mission Creek, to cost $120,000.

Kingston, Ont.

The following rates have been adopted in the city of Kingston. By this change, meter rentals are abolished, and it is claimed there will be a saving of about 25 per cent. to domestic users and 20 per cent. to commercial customers. Domestic lighting.—Three cents per 100 square feet of floor area per month, plus five cents per kw.h. for current used up to three kw.h. per 100 feet of floor area, plus 10 kw.h., with a minimum of 10 kw.h. All in excess, 2½ cents per kw.h. Ten per cent. discount for prompt payment. Commercial lighting.—Ten cents for the first 30 hours' use of a connected load. Five cents per kw.h. for the next 70 hours' use of a connected load. All in excess, 2 cents per kw.h. Ten per cent. discount for prompt payment. Power rates.—Service charge of $1 per h.p. per month, based on connected load or maximum demand. Plus five cents per kw.h. for first 50 hours' use of connected load or maximum demand. Plus three cents per kw.h. for the next 50 hours' use of connected load or maximum demand. Plus one cent per kw.h. for all excess. Ten per cent. discount for prompt payment. No class discounts.

London, Ont.

The Western Counties Telephone Association held their Annual Convention in London on June 21. Mr. George Taylor, the president, spoke briefly on the progress of the Association during the past year. Mr. F. Dagger, telephone advisor to the Ontario Railway and Municipal Board, addressed the convention on "Commission Controlled Telephone Systems." Other addresses were given by Mr. Anson Groh, of Preston, manager of the Waterloo Telephone System; Mr. A. McLean, Paisley, of the Bruce Telephone System; Mr. A. Denholm, Blenheim, president of the Canadian Independent Telephone Association, and Mr. S. L. Squire, Waterford, of the Norfolk County Telephone Company. The officers elected for the ensuing year were:—Geo. Taylor, hon. pres.; F. S. Scott, pres.; W. McCredie, first v. p.; Dr. Doan, Harrietsville, secretary-treasurer.

Montreal, Que.

Mr. Alec Wilson, distribution engineer of the Montreal Light, Heat & Power Company, was married on Tuesday, June 15, at St. George's Church, Montreal, to Miss Alice Thompson, of Montreal.

The Speaker's Patriotic League is a Montreal organization which has made a special appeal to employers to encourage enlistment among their men. Among the firms which have promised to show special consideration to men going to the front are:—the Bell Telephone Company, Montreal Light, Heat and Power Company, Northern Electric, and the Shawinigan Water and Power Company.

The city of Calgary have awarded contracts for the supply of two and three conductor lead covered paper insulated cable to the Eugene F. Phillips Electrical Works, Limited, Montreal, and the Canadian British Insulated Company, Limited, Montreal. The latter will supply 6,600 v., 3,300 v. and 300 v. cable.

Medicine Hat, Alta.

On Saturday evening, June 5th, fourteen new electric lights, placed on the store fronts by a number of the most enterprising merchants on the south side of Second Street, were illuminated for the first time. The new lamps are 1,000 kw., nitrogen filled tungstens, and were erected by Mr. Shardlow, of the Medicine Hat Light and Supply Company.

Peterborough, Ont.

The city council of Peterborough are submitting to the people a by-law for $50,000 for the purpose of purchasing a site for a sub-station and pole yard, water-works office, shops and pipe yard and other improvements to the lighting system.

Petrolea, Ont.

A by-law will be submitted to council, asking authority to expend $35,000 on a hydro-electric distributing plant.

Sudbury, Ont.

A by-law was submitted to the ratepayers on June 14th, authorizing the guarantee of bonds of the Sudbury & Copper Cliff Suburban Railway Company to the extent of $75,000

Electrical News

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Delivery Costs with Electrics

A recent investigation of the cost of maintaining electric commercial vehicles in 145 large installations in some 30 different cities showed that more than 3,000 electric vehicles included in the tables are now being operated for the following average daily costs:

1-3 ton	$5.68
½ ton	6.34
¾ ton	7.02
1 ton	7.56
1½ tons	8.15
2 tons	8.92
3½ tons	10.38
5 tons	11.74

Actual verifications in writing over the signature of the owner or operator, cover 50 per cent. of the cases investigated, while the others personally acknowledge the truth of the figures given.

The cost analysis included investment, spare parts, equipment, garage equipment, and office equipment on the total of which 3 per cent. interest was charged to annual operating expenses. These expenses also included depreciation at 10 per cent., liability and fire insurance and license fees. Maintenance included tire upkeep, battery upkeep, and mechanical upkeep. Electric power, supplies, labor, rent, light, etc., were charged to garaging. Driver's wages were charged to operation and salaries and office expense to administration. Current was figured in all cases at 4c. per kw.h., and wages were averaged at $2.00 a day for light delivery wagons, $2.50 a day for 1 to 3-ton trucks, and $3.00 a day for heavier trucks.

The average daily cost of all the trucks investigated were exceedingly low and many gratifying expressions were received from the owners and operators.

Within a period of ten years horse carriages have almost totally disappeared from the streets of the larger cities, and transition from animal to mechanical transportation of merchandise is now rapidly taking place. It is evident from all the available reports of comparative expense that the most economical system of delivery now in use is the electric truck.

C. E. A. Class "A" Members Convene

A meeting of Class "A" member companies of the Canadian Electrical Association was held in Ottawa on the 26th of June, in the Chateau Laurier. About fifty companies were represented, including practically all the larger ones. The president's report outlined the work of the past year and the secretary gave details of the activities of the association. The results of the method of co-operative purchasing which had been put into force three months previously were most satisfactory, and the secretary received instructions to secure special prices on further requirements of member companies, and also to carefully investigate and report on the opportunity of securing a reduction in premium by the co-operative method of placing insurance.

A full account was given of the formation of the Electrical Employers' Association, an offshoot of the Canadian Electrical Association, formed under the terms of the Workmen's Compensation Act in Ontario. This new body is accepted by the government as representative of the entire electrical industry, appoints its inspector who makes periodical visits to power and light plants and also manufacturing establishments, investigates accidents and their causes and possible obviation, and in general devotes himself, under the direction of the association, to effecting the greatest possible improvement in the conditions under which all electrical workers in the province are engaged.

The nominating committee amid the hearty applause of the meeting, asked that Colonel D. R. Street retain the chair for another year. It was felt by the entire gathering that Colonel Street's great services to the association demanded all recognition that could be given. Other officers appointed were:—D. H. McDougall, assistant to the manager of the Toronto Electric Light Co., 1st vice-president; W. S. Robertson, general manager, Electric Power Co., 2nd vice-president; H. G. Matthews, general manager, Quebec Railway, Light, Heat & Power Co., 3rd vice-president; Alan Sullivan, secretary-treasurer. New members on the managing committee are:—H. M. Hopper, manager St. John Railway Co.; A. Monro Grier, Canadian Niagara Power Co.; M. C. Gilman, sales manager Toronto Electric Light Co.; Jas. B. Woodyatt, manager Southern Canada Power Co., Montreal. Other members who continue to hold office from last year are:—W. G. Angus, Dominion Power & Transmission Co., Hamilton; P. T. Davies, Montreal Light, Heat & Power Co., Montreal; A. E. Dunlop, Pembroke Electric Co., Pembroke; J. S. Gould, Citizens' Electric Co., Smith's Falls, Ont.; G. Ratcliffe Hulme, Canada Electric Co., Amhurst, N.S.; Geo. Kidd, B. C. Electric Railway Co., Vancouver; E. L. Milliken, Cape Breton Electric Co., Sydney, N.S.; J. S. Norris, Montreal Light, Heat & Power Co., Montreal; L. W. Pratt, Dominion Power & Transmission Co., Hamilton; the President, National Electric Light Association, New York.

Calgary Makes New Power Agreement

Commissioner Graves, Calgary, sends the following explicit details of the agreement that has been reached between the city and the Calgary Power Company. The advantage of the arrangement for both parties is evident:—

"To give a clear understanding it is necessary to state that in the past we have been purchasing 5,000 h.p. from the Calgary Power Co., at $26 per h.p., which gives them a load factor from 85 to 93 per cent., according to the seasons. The additional power that the city requires, varying from 2,000 h.p. in the summer to about 5,000 in the winter, and generally having a load factor of less than 50 per cent., has been generated by steam at the city's own plant.

"The city has a modern steam plant,—which has been described in the 'Electrical News'—with a capacity of over 12,000 h.p., and we have found it cheaper to manufacture the excess power over that contracted for, rather than give the whole load to the Calgary Power Co.

The service that has been given during the past eighteen months by the Calgary Hydro-electric Power Co. has been of a very satisfactory nature, and the company expressed its desire to supply the whole of our requirements, but as heretofore pointed out, the city could not entertain the idea at the scale of prices provided for in their contract, which reads as follows:—

First 5,000 h.p.	$26.00
Next 1,000 h.p.	25.00
Next 1,000 h.p.	24.00
Next 1,000 h.p.	23.00
Next 1,000 h.p.	22.00
Next 1,000 h.p.	21.00
Next 1,000 h.p.	20.00

"Finally, a satisfactory arrangement was arrived at whereby the company would pay the expenses of a nucleus staff and all coal and gas that might be used in firing the boilers to keep up a supply of steam at all times, sufficient to protect the down-town district, and in the event of any longer interruptions the company agrees to meet all expense in starting up the whole plant. The staff and the operation of the plant are left entirely in our hands as heretofore. This contract is for a period of one year.

"We anticipate that there will be a large saving to the city, and the Calgary Power Co. will benefit very materially also from this arrangement."

Snow Strain on Pole Line

Herewith we reproduce a photograph which well depicts the tremendous strain imposed on pole lines in the mountain district of British Columbia during the period of heavy snowfall. The section of C. P. R. line shown spans a ravine between two mountains near Glacier, and the "trouble" man in the picture, who is about to remove the "mushroom" cap from the pole close by, is standing on a

A severe test of service.

snow bank fully 30 feet in depth. The snowcap on the pole is over six feet in thickness and over eight feet in length. The crossarms on the pole are 7 ft. 6 in. in length, and are completely hidden. The picture will serve to bring home to our readers the difficulties met with in maintaining an uninterrupted telegraph and telephone service through 600 miles of mountain country in the winter months. That there are few breaks is a tribute to the watchfulness of the repair gangs and the good work of the line builders.

Standardizing Vandalism

Shooting holes in aerial telephone cable has apparently become a standard form of diversion for a certain irresponsible element. Every summer the Bell Telephone Company has to repair enormous stretches of aerial cable, which when taken down show bullet holes made by vandals who seem to care nothing for the vast damage and inconvenience they cause. A bullet in a telephone cable may cut off the service of a hundred or more subscribers, and the telephone people every summer receive endless complaints of service interfered with in this way. This damage to cables occurs chiefly along the river and lake shore. In the Point Claire -Beaconsfield cable 25 bullet holes were located in less than two feet of 19 gauge cable. Shots are continually being fired also into the cable terminals on the poles, with the result that the intricate apparatus is deranged and the service of dozens of subscribers cut off. The Bell Telephone Company intends taking vigorous measures to stop this wholesale wrecking of its property by vandals with rifles. In furtherance of its campaign in this direction the company offers a reward of $50 for information leading to the conviction of anyone guilty of this form of vandalism.

Low Head Dams on Bow River

The Alberta Hydro-electric Company, Limited, has submitted a proposition to the city of Calgary, asking for a contract for a minimum of 4,000 h.p. and a maximum of 10,000 h.p. for a period of five years at the following prices:—

For the first 4,000 h.p. $22.00 per h.p. per year.
For the next 1,000 h.p. 21.00 per h.p. per year.
For the next 1,000 h.p. 20.00 per h.p. per year.
All over 6,000 h.p. 19.00 per h.p. per year.

The company purposes building a series of low head dams on the Bow River within the city limits and promises to have the first one ready by May 1st, 1916, and supply the city with the excess power over and above the Calgary Power Company's contract, which is 5,000 h.p., and, as has been stated elsewhere, would vary from 2 to 5,000 h.p. At the expiration of the Calgary Power Company's contract, they wish to take over the whole of the city's business, and in the event of any diminutions of power during the low water periods, will pay for the cost of operating the city's steam plant. The company states that the finances are already arranged, should the city enter into a contract.

It is maintained that the carrying out of this proposi-

tion will give considerable employment at the present time and will eliminate long transmission lines and consequently reduce the danger of interruptions to a negligible quantity. The matter is now before the Power and Development Committee, who have the proposition under consideration.

Regulating Gates at Shawinigan Falls, Que.

The accompanying illustration gives a general view of one section of a movable steel dam built for the Shawinigan Water and Power Company at Shawinigan Falls, Que. This dam consists of two portions, as the river is divided into two channels by an island. One portion consists of eight gates, and the second portion, which is the one illustrated, consists of twelve large and two small gates. All the large gates are 40 ft. wide in the clear between piers, 18 ft. high, and 21 ft. lift. The small or regulating gates are contained in the gate house. They are 16 ft. wide and 18 ft. high, with 21 ft. lift. The large gates are lifted by means of travelling hoists which run along the bridge, which is supported by towers on the masonry piers. Hoisting is done by means of screws which connect with the vertical end girders of the gates. When lifted to their highest position, the gates are sustained by being connected directly to the bridge through locking pins, which are operated by a hand lever from the platform of the hoist. The hoisting screws may be disconnected and the machine used for lifting other gates. In the illustration all the gates are lifted to their highest position. Two hoists are provided for the 12-gate section of the dam, and one hoist for the 8-gate section, all of which are operated electrically. The boiler shown in the illustration on the platform of the hoist is used for freeing the gates of ice when this becomes necessary. The small gates in the gate house are provided with individual screw hoists of a type similar to those mentioned.

Prince Rupert Turbo Plant

The Grand Trunk Pacific drydock, Prince Rupert, B. C., now nearing completion, at a cost of two and a half million dollars, will be electrically equipped. The power house, 104 x 148 feet, constructed of steel and concrete, contains two 1,000 kw. turbine generators and a steam-driven air compressor of 1,500 cubic feet capacity. There are also six 400 h.p. water tube boilers supplied with automatic stokers of the chain grate type. A system of underground electrical conduits has been installed throughout the shipyard. On the dock three air compressors of 500 cubic feet each and twelve 24-in. centrifugal pumps are electrically driven. Each shop and the power house are equipped with a 15-ton electrical overhead crane.

Dorchester Electric Sold

Only one bid was made for the assets of the Dorchester Electric Company when these were put up at auction at Quebec on June 30. The bid of $100,000 was made by Mr. C. H. Branchaud, broker, of Montreal, a director of the Dorchester Company, and also one of the incorporators of the new hydro-electric company formed to supply power to Three Rivers and Quebec and several counties. The sale was made by the Royal Trust Company, Montreal, on behalf of the holders of first mortgage bonds, on which interest was defaulted. A Quebec correspondent reports that action has been entered to annul a contract on behalf of Messrs. Victor Ouellet, Aldrique Simoneau and Hubert Fraser, of Cape St. Ignace, against the Royal Trust Company and the Dorchester Electric Company. The plaintiffs claim irregularities in the contract.

The official opening of the Chatham Municipal Hydro-electric System was held on July 7th.

Section of a movable steel dam built by the Dominion Bridge Company, for the Shawinigan Water and Power Company.

The Effective Illumination of Streets

A discussion of the fundamental purposes to be served by Street Illumination, and the best methods to adopt under varying conditions.

by Preston S. Millar*

Improvement in street lighting involves (1) larger municipal appropriations; (2) more efficient lamps and accessories; (3) greater skill in application.

Larger Municipal Appropriations.—The public is gradually becoming acquainted with the advantages of more liberal use of light. Use of the streets at night is becoming more general throughout a greater number of hours. Requirements for good street lighting are becoming greater as traffic becomes denser and as traffic speed increases. Also the advertising value of extensively employed light is commanding appreciation in mercantile lines. These things combined are leading to larger municipal appropriations. Larger appropriations mean betterment in street illumination because the mere addition of lamps with no increase in lighting efficiency and no greater skill in application usually improves conditions. The greatest single obstacle to satisfactory street illumination is lack of funds.

More Efficient Lamps and Accessories.—The last two years have witnessed increases of 25 to 50 per cent. in efficiencies of street illuminants, the Mazda C incandescent lamp and the magnetite arc lamp having progressed contemporaneously. At the present time in the magnetite lamp of medium and high power, in the Mazda C lamp of low, medium and high power, and in the flame arc lamp of high power there are available illuminants having efficiencies four or five times greater than those of various types of enclosed carbon arc lamps which were the principal street illuminants in this country a few years ago. Some advance has been made also in the design of lamp equipment, notable among which are the prismatic refractor and a variety of light-density translucent glassware which combines fairly good diffusion with high transmission. These improvements in the materials of street illumination combined with the increased sums which municipalities are appropriating make possible a very general improvement in street lighting.

Skill in Application.—Recently installed systems are almost invariably superior to the systems which they replace. Usually the improvement is due in part to greater skill on the part of the engineers in charge. City engineers, central station engineers and manufacturers are better acquainted with the problems and have acquired more skill in meeting them. The result is street illumination of greater effectiveness. Notwithstanding this advance there are but few principles of street illumination which are regarded as thoroughly established. Although the subject has received perhaps more than a fair share of discussion and study, it is still enveloped in much uncertainty. In the literature and in practice there is much which indicates differences of opinion in regard to principles of fundamental importance. It must be admitted that progress in the conception of correct principles is slow. Yet there is progress, and it may be that by the time most street lighting is made good, those of us who talk and write of the principles may reach an agreement as to what constitutes good street lighting.

It is the purpose of this paper to discuss the variables of street illumination and the principles underlying the best use of modern illuminants and accessories under modern conditions in this country. We shall consider therefore matters pertaining more especially to the third factor entering into improvement in street illumination as enumerated in the first paragraph.

Classification of Streets

For the purposes of this discussion the following classification of streets is adopted:

Class	Description
1a	Metropolitan thoroughfares of greatest distinction.
1b	Important city streets largely travelled at night.
2a	Business streets not largely traversed at night.
2b	City residential streets.
3a	Suburban residential streets.
3b	Suburban thoroughfares.

It will be apparent that requirements for street illumination are diverse as among these different classes of streets. For example, the 1a class of streets is distinguished by a requirement for dignified, pleasing fixtures and for lamps and illumination which should be of fairly high intensity, lighting building fronts as well as street. Streets of the 1b class are likely to be characterized by much show-window and sign lighting which augments the street illumination during the hours of greatest traffic. Here intensities are likely to be highest, and the ordinary fundamental requirements of street lighting are supplemented by the desirability for recognizing acquaintances in the passing throng and for detailed vision, approaching that common to interiors at night.

In streets of the 2a class a moderate intensity of illumination which lights building fronts as well as street is customary. Policing purposes and good seeing conditions for the occasional pedestrian are the principal desiderata. In streets of the 2b class it is usually desirable to keep the light upon the street surface, avoiding brilliant illumination of the upper storeys of residence fronts and providing fairly good lighting for the low density vehicular and pedestrian traffic.

In streets of the 3a class it is likewise desirable to keep the light upon the street, illuminating the sidewalks well to serve the purposes of pedestrians. In streets of the 3b class, which are the important automobile highways connecting populous centres, the principal requirement is that of the automobile driver. Here the most difficult problems of street illumination are encountered.

The discussion in this paper is applicable in varying degree to streets of these six classes.

Objects of Street Illumination

From several points of view the objects of street illumination may be stated in somewhat different ways. The point of view of the motorist differs from that of the pedestrian which in turn differs from that of the police commissioner and from that of the merchant. When, however, one assembles the considerations growing out of all these several viewpoints, those of first importance appear to fall within the comprehensive classification presented by the National Electric Light Association Street Lighting Committee in 1914 which is as follows:

Fundamental Purposes to be Served by Street Illumination

1. Discernment of large objects in the street and on the sidewalks.
2. Discernment of surface irregularities in the street and on the sidewalks.
3. Good general appearance of the lighted street.

It would appear that in proportion as these three pur-

*Presented at 32nd Annual Convention of American Inst. of Electrical Engineers.

poses are served the street illumination will be regarded as satisfactory, and it may be concluded that no street lighting installation which serves these three purposes reasonably well can be regarded as unsatisfactory. The weight to be given each will vary in different streets though in a general way it is probable that the purposes are served in the order named. It is possible to install at a low cost a system which will reveal large objects (purpose No. 1) while failing to serve the two other purposes. With increased appropriations, or more efficient illuminants, large objects may be revealed to better advantage and surface irregularities (purpose No. 2) may also be revealed although the third object may not be served. With still larger appropriations and still more efficient illuminants, discernment may be improved and a pleasing appearance for the street (purpose No. 3) by day as well as by night may be had. All three objects may be served when appropriations are adequate.

Processes of Seeing

In streets at night objects are seen by reason of contour, relief, shadow or color.

We perceive the contour of objects when they are markedly different in brightness from their background. Since most large objects on the street at night are darker than their background we perceive them usually as silhouettes.

Contrasts in relief are perceived when the exposed surface of an adequately illuminated object presents areas of different reflecting powers, or elements which are more or less favorably inclined with respect to incident light, or elements which lie in the shadow of other elements of the surface.

We may perceive small objects by reason of their

Fig. 1

shadows occasioned by the interception of sharply inclined rays of light. Shadows of large objects are not always of value in promoting discernment and are often misleading as in case of the shadow of a telegraph pole thrown across the sidewalk.

Color contrasts are not usually relied upon since in installations where discernment is at all difficult, color is usually lost and objects are perceived more readily by other means.

The several kinds of contrast perception are suggested in Figs. 1 and 2, made from a series of photographs of test targets. These have been located successively in six representative positions between lamps in a street where both centre and curb (both sides) units were installed. Fig. 1 shows the lighting effects by the centrally mounted lamps. Fig. 2 corresponds with using the curb lights only. The targets are substantially the same color as the street surface. It is to be noted that those which are most clearly revealed receive the least light and are silhouetted against their background. Those least distinctly revealed receive on the observed surfaces about the same light as their background.

Contrast perception is the ruling visual process with

Fig. 2

which street illumination is concerned. To increase contrasts on surfaces to be seen is to better conditions for vision.

Some Considerations Which Are Often Ignored

In much of the literature of street illumination, curves of illumination intensity form the principal basis of judgment as to effectiveness. There is a tendency to over-emphasize the importance of incident light to the prejudice of other important considerations. Three of the principal considerations which are not emphasized directly by study of illumination intensity curves are presented in the following paragraphs.

Silhouette Effect.—When the writer directed attention to the silhouette effect in 1910, there existed but little appreciation of its importance. During the five years which have intervened there has gradually developed a greater appreciation of the extent to which it enters into conditions of visibility in street illumination. Yet its very general applicability even now is unrecognized by some engineers. There is an impression that only in lighting of very low intensity is it the prevailing method of discernment. As a matter of fact the silhouette effect is pronounced whenever there are bright street or building backgrounds. A photographic under-exposure of any street in the daytime shows objects as silhouettes. The casual glance of an automobile driver corresponds roughly with such an under-exposure. The majority of observations of large objects on the streets in our more intensely lighted thoroughfares, especially in the practice of automobile drivers, falls under this heading, because a driver is concerned primarily with avoiding obstacles and usually

looks carefully enough only to detect the presence of pedestrians and other objects. Usually he sees these as dark objects silhouetted against the lighter street surface or building surfaces. The pedestrian too obtains distant views of large objects as silhouettes, but as he moves more slowly and approaches objects more closely, he has opportunity for closer observation, and in the more brightly lighted streets supplements discernment by silhouette with actual observation of surfaces in relief.

Nature of Street Pavement.—Modern streets which require greatest care in lighting are traversed by automobiles. The majority of them are paved with asphalt, asphalt block, wooden block, treated macadam, etc. As a result of automobile traffic such pavements become oiled and polished. The high spots of the pavement then reflect specularly.

Figure 3 shows measurements of horizontal illumination intensity and of brightness at the angle of an automobilist's

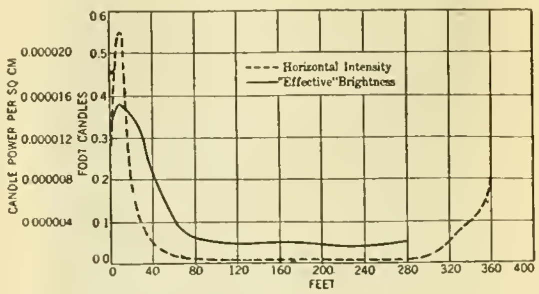


Fig. 3

view. The broken line shows horizontal foot-candles as measured on East 80th Street, New York City. This has an ordinary asphalt pavement and is illuminated by multiple enclosed arc lamps 365 feet apart. The continuous line shows brightness values. It will be noted that whereas the foot-candles vary in the ratio of 46 to 1, the brightness varies in the ratio of 8 to 1. This is a street in which automobile traffic forms but a small part of the total traffic.

Figure 4 shows corresponding data for upper Seventh Avenue, New York City, which is a street largely traversed by automobiles. The street is paved with block asphalt; the horizontal foot-candles vary in the ratio of 10 to 1. The effective brightness varies in the ratio of 2 to 1. The impression of uniformity which one derives from a trip through the street is expressed by this brightness ratio rather than by the foot-candles ratio. On this street, which is of the boulevard, central parkway type, there are three lines of lamps. The linear spacing of the lamps is about 125 feet. As the street is fairly level, a great number of these lamps is within view at a given time. The street surface consists largely of small polished areas which reflect specularly. In driving through the streets one sees reflected in these small polished areas imperfect images or part images of distant lamps. Notwithstanding the rather wide spacing and marked non-uniformity of illumination intensity, the effect is one of remarkable uniformity of lighting. In driving one looks at the street surface 200 feet or more away, and the surface which one sees is rendered bright by lamps which may be one-quarter, one-half or even one mile away. Consequently the surface between lamps viewed from this angle is almost if not quite as bright as is the surface near or directly under the lamps.

Any street which is largely traversed by automobiles, and which has pavement of the types named above, is likely to appear rather dark because of the oil which is deposited upon it from automobiles. It is, however, a most favorable surface for street lighting purposes because of its tendency to reflect specularly. It was found that Seventh Avenue, New York City, described above, has three to four times the effective brightness per lumen of incident light as another prominent thoroughfare which is paved with Belgian block.

Recognition of the fact that modern streets are likely to be characterized by more or less of this specular quality necessitates important alterations in some of the theories regarding street lighting which have prevailed in the past and which are held at the present time by some engineers.

Relation Between Lamps and Street Surfaces

The effect of glare in street illumination is dependent primarily upon:

1. The extremes of contrast within view; that is, contrast in brightness between the light source and the illuminated surfaces.

2. The visual angle separating the glaring source from the observed surfaces.

3. The portion of the field of view which is illuminated.

Glare militates against good street illumination, first in decreasing ability to see, and second, in rendering unpleasant the appearance of the installation and the street. Insofar as it reduces visual power it manifests itself in three ways:

First, actual diminutions in ability to perceive small contrasts in the presence of a bright light source.

Second, distraction of attention as a result of which small contrasts may not be perceived when viewed casually.

Third, a temporary dazzling effect which persists for a few moments after a bright light source is viewed directly.

If a single brilliant light source, as a bare Mazda C lamp is located over a dirt road in the country, the glare is very bad. If the lamp is raised to a greater height or moved to one side of the road, or if the lamp is enclosed in a diffusing globe, the glare is lessened. If a number of additional lamps are strung beyond it along the road, the glare is further reduced. If the lamps, instead of being located over a dirt road, are located over a treated macadam road, or better still, over an asphalt road, the glare is less serious. Light colored buildings along the street also assist reducing the glare. In short, anything which reduces the contrast between the light source and the road surface, or which separates the bright light source from the road surface, reduces the effect of glare.

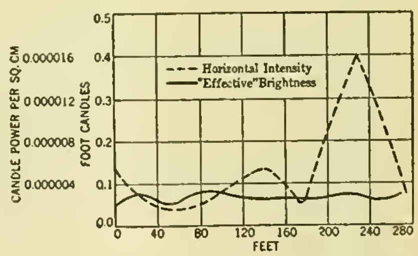


Fig. 4

Sweet, in 1910, studied that part of the effect of glare which is a measurable reduction in the ability to see, using a single light source in a dark room. He found under these exaggerated conditions that a large reduction in visual power could be traced to the presence of a bright light source close to the centre of the field of vision. In 1911 working with others on the campus of the University of Wisconsin, he pursued his researches, and has given preliminary publication to some very interesting results. In this latter research he employed from two to four lamps mounted at various heights and with various spacing intervals over a dirt road about 350 feet long. It is not proposed at this time to enter into a discussion of these tests, but it may be noted that the only conclusions which they can indicate are those which would apply to a short stretch of dirt road. The modifications introduced by street pavements of better reflecting

qualities, by building along the street, and by a greater length of illuminated street, have no part in this research. This is a serious limitation, because the effect of glare in street lighting is very largely reduced by each of these three factors. The two researches make available valuable information which has its bearing upon street lighting principles. If, however, the data are considered without due regard to the limitations under which the tests were made, there is danger of forming an exaggerated idea of the importance of adopting measures which will reduce the effect of glare by decreasing the brightness of light sources to low values. Since the problem is really one of reducing contrast between the light source and the illuminated surfaces, the more constructive way of accomplishing the desired end is to increase the brightness of the illuminated surfaces rather than to dim the light sources unduly. Excessive brightness of light sources must of course be reduced. It is common experience that a simple diffusing globe accomplishes this reasonably well under most conditions. Too great reduction in the brightness of the light source is unsatisfactory psychologically. We like a bright light source—we are dissatisfied with illumination in which a bright light source is not visible. Therefore the thing to do is to eliminate glare by increasing the brightness of the street surface, and where desirable, that of surroundings, and by reducing the brightness of the light sources moderately throughout the angles at which they are viewed.

With these considerations concerning the importance of the silhouette effect, specular reflection from pavements and glare well in mind, we may proceed to a discussion of the variables of street illumination and of the several factors which the engineer must study in planning a street lighting installation.

(Concluded in August 1 issue.)

Electrically-Propelled Fire Apparatus

Notes on Their Successful Operation in Various Cities—Dependability, Economy and Speed, Important Factors

By A. Jackson Marshall*

Ever since the first fire department was organized in ancient Rome, for centuries countries have vied with one another in the development of efficient fire controlling apparatus, endeavoring to make fire the "servant" rather than the "master" of man. One of the greatest problems has been the propulsion of fire apparatus, and at present the greatest effort is being made to develop motor-propelled appliances. It is interesting to follow the development of fire-fighting from the early period when the "bucket brigade" was the most efficient means of combating the enemy. The hand engine and man-pulled hose carriage were considered marvels of efficiency in their day, but it is with a mixture of curiosity and amusement that we now look upon apparatus relegated to the glass cases and rusty environs of museums. In 1875, shortly after the period of the great fires which devastated some of our cities, a new movement sprang up which heralded the modern building era and modern fire-controlling appliances. It was at this time that steam engines came into general use. The inclusion of fire fighting amongst the scientific problems of the day as one worthy of serious consideration dates from modern times, and hence the many improvements which have been introduced into its practice are all of such recent origin that even now they are only just emerging from an embryonic stage.

It is with considerable interest that fire chiefs throughout the country are watching the results and performance of electrically-propelled fire trucks and engines in the cities where they have been adopted. The very many obstacles that present themselves in the changing of horse-drawn to motorized apparatus of a large fire department are such that the utmost care must be used to secure that method of propulsion for apparatus that will give speed, reliability, and efficiency, together with ease and economy of operation. In these points the advantage of the electric over other methods of propulsion is fast establishing itself.

The First Installation

The first storage battery driven fire engine in this country came into existence in 1912 when Engine 217 of the New York Fire Department was converted into an electrically-propelled apparatus. The Edison Monthly gives an interesting account of its history and operation:—

"The early history of 217 is well known. The engine, originally a horse-drawn steamer of the largest size, was converted into the motor type by the removal of its forward running gear and the substitution of two couple gear freight wheels, a storage battery and the necessary steering and controlling devices. This conversion cost $4,000 and it gave to the city an engine that would have cost not less than ten thousand dollars had new apparatus been purchased; in other words, a dependable steam pumping engine was continued in service with added speed and greater radius of operation.

"With the exception of battery renewals and replacement of minor parts, it stands today just as it did when it went in to service on April 24th, 1912. The bills for repairs and renewals during the two years have come to just $744.29, $486.97 of which was for battery renewals that were made after the machine had been in service a year and a half. The balance includes minor parts, labor and decorating, for the engine has taken part in two street parades. Adding depreciation and the cost of charging, operation of this engine has cost the city just $1,370.03.

"The cost of motive power for this same type of engine, but with horses instead of a storage battery, is $1,469.06 for two years. These figures are based on the records of two stations which ordinarily respond to about the same number of calls as 217. The sum includes depreciation on horses and harness and stable equipment, which at ten per cent. is $105.98 a year. Feed, shoes, and veterinary service for three horses cost $516.86, while the repairs vary. As a rule, better service costs more money. In this case the Fire Department not only has a better piece of apparatus, but one on which it is saving money. The economy claim is supported by the records of the department—the claim of superiority is based on the actual performance of the engine. In the case of fire fighting this is rated principally by the speed in getting to the blaze. To begin with, the engine saves time in getting out of the house, for there are no horses to harness (incidentally the passing of the horse has done away with the stalls, and the space thus saved is utilized for garaging the car of one of the department chaplains). With no time lost in harnessing and with greater speed through the streets and a wider range of operation, No. 217 is often the first engine at hydrants to which in the days of the horse it was due third."

The experience of Philadelphia with electric fire apparatus has been most successful. Two years ago the first step was taken, and Engine No. 20, a first-class steam fire engine weighing 10,500 pounds, horse-drawn, was equipped with an

* Secretary Electric Vehicle Association of America.

attached two-wheel storage battery tractor. The excellent performance of Engine No. 20 during the tests made in the conjested traffic zone induced the Bureau to convert two smaller class steam fire engines, horse-drawn, to battery tractors, also the two horse-drawn, high pressure hose wagons to storage battery apparatus. In addition to these five pieces of electric apparatus the city of Philadelphia has recently ordered two combination hose and chemical wagons, and one 65-ft. aerial truck to be storage battery driven. This re-order should be especially gratifying to the manufacturer, as showing that the electric has proved satisfactory under high speed conditions. In a report on electric fire apparatus given by chief mechanician George S. Walker before the Electric Vehicle Association Convention last year, some very interesting tests were described, in which the electric excelled all the specifications demanded. In one performance of a fire engine equipped with electric tractor, a distance of four miles was covered in eleven minutes, while the same distance consumed 30 minutes with horse-drawn apparatus. Chief Walker says of this performance:—

"This test was made to corroborate our belief in the battery tractor, and any person conversant with the territory traversed is well aware that it is no easy going. Along that route there are many hills, and one extremely sharp, dangerous curve, and the time made on that run, 11 minutes, stands today as record time not excelled by any fire apparatus of any make, weighing very nearly six tons, over the same route. . . . . . . The facts presented to me after over a year's experience are so satisfactory and the results so gratifying that I unhesitatingly say that for use in the conjested traffic zone and the close adjacent territory thereto, of any large city similarly situated as is Philadelphia, the storage battery tractor is the very best method of propulsion for fire apparatus that is presented by any present-day methods, and I sincerely wish that the Bureau will be able in the near future to receive the necessary funds, that the present small number of motor apparatus may be so augmented that our city will possess the requisite number of apparatus that modern methods demand of the Department of Public Safety."

No more convincing proof of the superiority of the electric fire apparatus could be obtained than a letter from Chief Engineer W. B. Daggett, of Springfield, Mass., in which he states that the actual use in the service of the department has shown one of the chief advantages of battery-driven apparatus to be absolute positiveness in starting.

"The pieces we have here," he states, "have never failed to start instantly, and our experience with them has been such as to inspire a feeling of confidence that they are sure to start when needed, at any time or place.

"We have as good gas cars as are owned by any city, but there are times when the crank is used more than once to start the engine, and as the larger the engine the more time it takes, also the greater the difficulty to spin. Up to the present time we have not thought of failure in starting with our battery-driven apparatus and no piece has been out of service a minute since they were installed.

Maintenance is Low

"The battery in the aerial truck is two years old. It is my belief, that making due allowance for the operation of the batteries under adverse conditions, the cost of maintenance of a piece of apparatus is as follows:

Renewal of plates (in four years)	$500.00
Renewal of separators (in two years) 30 cells at 35c.	28.00
Charging batteries (in four years at $60 per year).	240.00
Broken jars (four years at $7 per year)	28.00
Total in four years	$796.00
Total in one year	199.00

"In other words, I estimate $200 per year as the cost of maintenance of a battery-driven aerial ladder truck of such size and capacity as was formerly drawn to fires by three horses."

When it is considered that the maintenance and upkeep of three horses varies from $500 to $600 per year, it is evident why Chief Daggett is so enthusiastic in his report of the electric apparatus.

In Baltimore, Md., Engine No. 32 of the Fire Department is equipped with a storage battery tractor, "which," says Chief Enrich, "is the most reliable and economical apparatus in the whole department, and can always be depended upon."

The city of Akron, Ohio, owns a 65-ft. aerial truck equipped with electric tractor which, at a demonstration of speed and climbing grades, went up a 13 per cent. grade when carrying a full complement of men and equipment and attached to the truck, at the rate of 11 miles per hour, and on level streets the tractor propelled the truck at the rate of 26 miles per hour without any trouble or showing in the least any loss of power.

"In my judgment," said Chief Mertz, "the storage battery has solved the problem of converting horse-drawn steam fire engines and hook and ladder trucks of any fire department to self-propelled apparatus from a practical standpoint."

As in other departments where the horse is being superseded by self-propelled vehicles, it will not be long before every fire department of any size will be entirely motorized.

It is now a question which will prove the most efficient means of propulsion, petrol or the storage battery. It is an established fact that the electric vehicle is more economical to run than a gasoline car. Without doubt the gasoline vehicle has its own sphere, and as Chief Avery, of Worcester, Mass., states, its use in suburban districts will not be superseded, but for the exacting work in the conjested and business centres "the electric vehicle," he states, "will be the future machine for fire-fighting."

The economy of operating an electric is due largely to its few working parts. As against the gasoline motor and transmission and the large number of working parts, a number of which are reciprocating in their action, the electric is driven by one, two or four motors, as the case may be, and the movement is a revolving one, the least wearing of all movements. In addition, these motors are revolved by electric magnetism and not by destructive explosive forces. The electric car has less than one-half the total parts required with a gasoline car. The life of the storage battery in this class of service is estimated at upwards of five years with one renewal. This estimation is given by Chief Daggett, of Springfield, who has had considerable experience with electric fire apparatus.

Figures Are Dependable

As for reliability, many of the above statements of various fire chiefs bear witness to the absolute dependability of the electric. Its ease of operation and promptness of action arouse utter confidence in it. "The battery tractor has the advantage of the gasoline apparatus," states Chief Walker, "in answering alarms, due to the fact that it is simply necessary for the driver to get on the seat, throw on his controller, and it is under headway in less time than is taken to crank the motor. It eliminates the characteristic ignition and carbureter troubles in starting the motor in cold weather, and the attendant radiator troubles of freezing and leaking."

Another characteristic of the electric fire apparatus which commends itself to the heads of fire departments, is its absolute cleanliness. The electric does away with the offensive odors of horses, and the customary litter, dirt and flies, allows more room in the station, eliminates all odors of gasoline and oil, reduces the element of fire, which is characteristic of gasoline equipment. As there is comparatively no grease it is much easier to keep the apparatus clean and of good appearance, all of which adds very greatly to the sanitation of the station.

Medicine Hat's Power and Pumping Plant

Three 750 Kv.a. Condensing Type Steam Turbo-Generators Operated by Gas-Fired Boilers—First in Simplicity and Reliability

In 1912 the City of Medicine Hat, Alberta, undertook the installation of a new power, pumping and filter plant.

The scheme recommended included:—

1. A concrete intake pier with a 30-inch cast iron intake pipe from it to a suction well on the river bank, which was already under construction.

2. A 6,000,000-gallon-a-day mechanical gravity filter plant, with provision for a minimum of three hours' sedimentation and a clear water basin under the filters with a capacity of 125,000 gallons.

3. Three 3,000,000-gallon-a-day low lift pumps for pumping raw water from the suction well to the coagulation basins or to the condensers as hereafter described.

4. Three 3,000,000-gallon-a-day high lift pumps for raising filtered water from the clear water basin to the service reservoir or pumping it into the distribution system.

5. Four 400 h.p. water tube boilers set in two batteries.

6. Three 750 kv.a. condensing turbo-generators with an overload capacity of 25 per cent. for two hours.

7. A 3,000,000-gallon service reservoir on the site previously referred to.

8. 9,500 feet of 20-inch rising main from the plant to the reservoir, with an 18-inch feeder off the main along Sissons Street for 11,000 feet to connect with the low level system through a pressure regulating valve set to maintain a pressure on this system practically the same as that previously afforded by the old standpipe.

Choice of Prime Mover

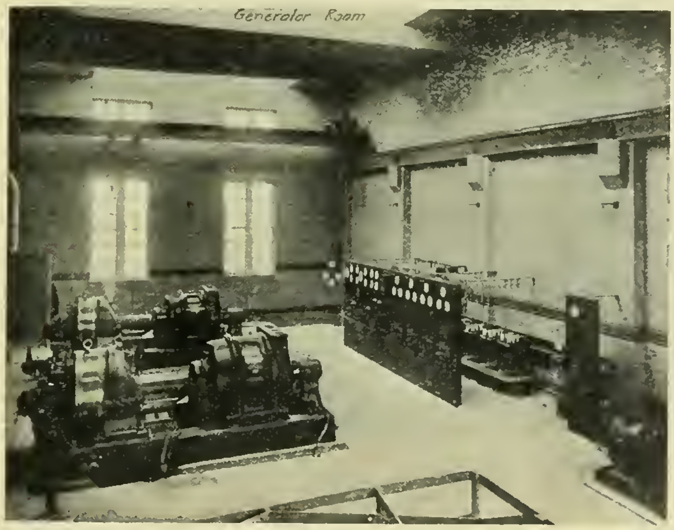
The selection of the type of prime mover to be adopted for the new plant was an important matter. The choice lay between gas fired steam boilers with turbo-generators and gas-engine driven generators. The steam plant was the cheaper one to install, was more flexible, and was considered more reliable and easier to maintain, but was admittedly inferior to the other from the point of view of fuel consumption. Another factor which had to be considered was the possibility of the city's being obliged to resort to the use of coal fuel. It is considered unlikely that such a contingency will arise, at least during the life of the present plant. Both types of prime mover permit of changing over to the use of coal, but the steam plant is the more convenient and economical in this respect, as no provision in the power station for additional equipment is needed. Hence, having regard to the low cost of fuel, it appeared that the considerations governing the choice of prime mover were, in order of importance:—1st, simplicity and reliability; 2nd, first cost; 3rd, cost of operation, including operators' salaries, cost of renewals, and repairs. Gas fired boilers and turbo-generators were therefore recommended, with all pumps and other secondary equipment motor-driven except the boiler feed pumps and one reserve exciter unit.

Power Plant

The following description of the power plant will be found of interest.

The boiler room and generator room floors are on the same level. The boilers are gas-fired, and induced draught is provided by two steam-driven fans in the smoke duct, discharging immediately above the roof through an 8-foot steel stack. Each boiler has 4,020 sq. ft. of heating surface. There are two feed pumps—a multi-stage turbine pump driven by a steam turbine, usually in service, and a reciprocating pump as a standby. Both feed pumps have suction connections under a moderate head from a concrete feed water tank in the corner of the boiler room, which can be filled off the discharge main or by the service pump drawing from the sedimentation basins. The feed pumps and fan engines exhaust into a Reilly multi-coil vertical heater.

Each turbo-generator unit consists of a Fraser and Chalmers 3,600 r.p.m. steam turbine direct connected to a Siemens 2,200-volt, 3-phase, 60-cycle, 750-kv.a.



Turbo-generators and switchboard—Medicine Hat.

generator. A Koerting ejector condenser is provided for each unit, and the injection water for the condenser is taken from the discharge header of the low lift pumps through a small centrifugal booster pump to increase the pressure of the discharge of the low lift pumps sufficiently for the condenser supply. The discharge from the condenser enters an open concrete hot well. A common motor drives both the booster pump and a small centrifugal return pump with submerged suction in the hot well which returns any desired proportion of the water from the hot well to the coagulation basins. This is effected by connecting the low lift pump header through a pipe with the discharge of the return pump. After the junction of the return pipes, the water flows through one pipe equipped with a water level controller, to the coagulation basins. Thus there are, so to speak, two circuits for the low lift pump discharge—one through the booster pumps, condensers and return pumps to the common supply main to the basins, and the other direct to this common supply main from the low lift discharge header. By simple hand regulation it is possible to turn any pro-

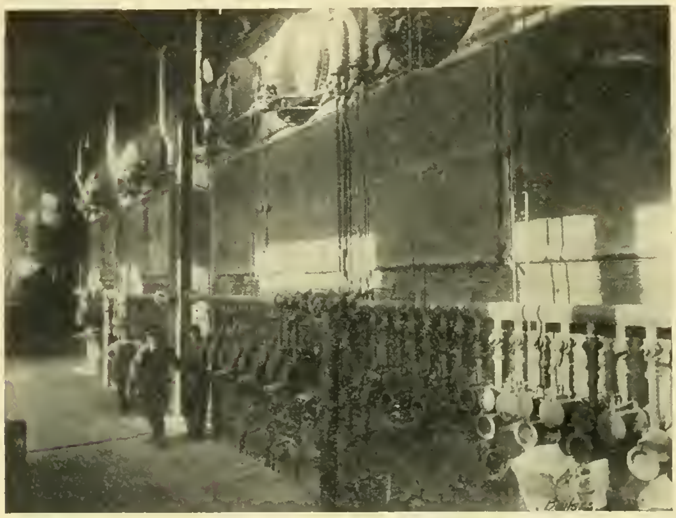
portion of the low lift pump discharge into the coagulation basins for the domestic supply, or any proportion of it may be used for condensing purposes and afterward returned to the coagulation basins for domestic use, or allowed to waste to the river through an overflow and drain from the hot well. All of the condensing water automatically runs to waste when the filters are shut down.

There are two exciter sets for the main units—one motor driven, and the other direct connected to a Terry steam turbine.

The main switchboard has eight panels—two for the generator control, one for the exciter control, one for the Tirrel voltage regulator, two for the outgoing lines, one for the high tension current supply to the high lift pump motors, and one for the supply to the transformers, which deliver 220-volt current for the low lift pump motors, wash water and circulating pumps, blower, exciter, lighting, etc.

The condensers, circulating pumps, air duct to turbines, service pump and transformers are located in the basement under the generator room.

The pump room floor is on two levels. On the



Gas fired boilers—Medicine Hat.

higher level, which is at the same elevation as the generator basement floor and the floor of the filter pipe gallery, are the high lift pumps, the wash water pump and the blower for the filters, and the switchboard controlling these units. The low lift pumps are on the lower floor, or in the pump pit, with shafts about 17 feet above low water. These pumps have independent 16-inch cast iron flanged suctions, laid in a concrete tunnel passing under the west coagulation basin to the suction well. These suctions are provided with foot valves, and the pumps are also equipped with ejectors for priming. The high lift pumps are two-stage Drysdale turbine pumps, direct connected to 325 h.p. Siemens induction motors, taking current at 2,200 volts.

In cold weather, one low lift pump can supply enough cooling water for two turbo-generators, but in the summer two low lift pumps are required for this service if it is desired to limit the temperature of the water entering the coagulation basins to about 80 deg. F. Condensing turbo-generators were adopted because, apart from being more efficient, this feature resulted indirectly in a lower first cost for the whole plant on account of the smaller boiler capacity required, thus showing a saving in the cost of buildings as well as in the cost of boilers. Impulse turbines and ejector condensers were adopted on account of their simplicity and reliability.

Electrical Distribution

The section in the immediate vicinity of the power house is supplied with electrical energy at 2,200 volts directly from the main station. Beyond this area the supply at the same potential is taken from a sub-station located in the industrial district of the city, about four miles from the generating plant. Transmission is at 13,200 volts. The sub-station is a reinforced concrete building with brick and tile curtain walls and concrete trim. At present it contains three 500 k.v.a. General Electric water-cooled transformers, with the necessary switching equipment. Space is provided for three more transformers, and there is a five-ton hand travelling crane serving the main floor.

In August, 1913, the engineer at the request of the city submitted a report and preliminary plans for a scheme covering the ultimate development of the plant within the limits of the present site. During the preceding year the development of the city had been remarkable, and the very favorable rates quoted consumers for electrical power had minimized the effect the offer of free or very cheap natural gas was expected to have in curtailing the demand on the municipal power plant. Larger sized units were recommended, suitable for a gradual extension of the plant. The ultimate capacities provided for were:—

Filter capacity	30,000,000 gals. a day
Boiler capacity	16,000 h.p.
Turbo-generator capacity .	24,750 kv.a.
High lift pumping capacity	33,000,000 gals. a day
Low lift pumping capacity	55,000,000 gals. a day

The cost of the initial installation was in the neighborhood of $500,000. Mr. R. S. Lea, M. Inst. C. E., of the firm of R. S. & W. S. Lea, consulting engineers, of Montreal, was the engineer for all of the work described, which was carried out during the tenure of office of Mr. A. K. Grimmer, Assoc. Mem. Can. Soc. C. E. as city engineer.

An Electrical Pioneer Passes.

A pioneer central station owner passed away on June 6th in the person of Mr. I. J. Gould, Uxbridge, owner and manager of the Uxbridge Electric Light plant. Mr. Gould was one of the earliest Canadians to back his faith in electricity with his capital, and established in 1878 one of the first arc street lighting systems in the Dominion. As early as 1892 he was operating 50-volt carbon incandescent lamps off his arc circuit for house lighting purposes. This plant has been maintained in a high state of efficiency up to the present time.

Though well known among central station men, Mr. Gould will be most widely remembered for his public services, having represented his local town and constituency for many years in both the Provincial and the Dominion Parliaments. He was also prominent in every local enterprise having as its object the development and welfare of his home town. He is succeeded as manager of the electric plant by his son, Mr. Walter Gould.

We are advised that in a communication of July 2nd, Mr. Sifton stated that 15 lamps, which had been installed on July 1st, 1914, were still burning, each having given a total of 3,931 hours of burning up to July 1st, 1915. This is a splendid example of the durability of the multiple type nitrogen lamp.

Electric Railways

The Landlord and the Bazaar

(A Modern Fable)*

Once upon a time there was a landlord. There was also a tenant, who, for many years, had conducted a business known as "The Emporium." This business, from small beginnings had grown to large proportions. The tenant paid a good rental for the premises occupied, and invariably paid on the first of the month, in advance. In addition to the rent, he paid the landlord annually a large sum from the proceeds of the business.

Naturally, the landlord had a high regard for the tenant, as the tenant had, by enterprising methods and fair dealing, not only built up a large business but had greatly increased the value of the landlord's holdings. The tenant had also expended large sums in improving the landlord's property, for new fixtures, etc., all of which became the property of the landlord under the terms of the lease, upon their installation.

One day a stranger, after observing the success attained by "The Emporium," came to the conclusion that he would like to participate in such a business. He noticed that "The Emporium" in order to serve all its patrons and the community generally, sold many staple articles and necessities in which there was little or no profit, as well as other articles and merchandise which were turned quickly at a fair profit.

Thereupon, he approached the landlord, and said, "I have a proposition to make you. I desire to start a business similar to that of "The Emporium," which will be known as "The Bazaar." I shall, however, sell only the quick-selling articles, in which there is a good profit. I will leave the slow-selling staples and unprofitable necessities to our friend who conducts "The Emporium," as I do not care for that class of trade. My clerks will operate on roller-skates in the aisles of "The Emporium," which are broad and roomy, and will sell my goods from "The Emporium's" fixtures. Just think what a great novelty that will be!"

"Well," said the landlord, somewhat astonished, "your proposition certainly has the merit of being new and novel. Let me see if I understand you aright. You want to engage in a business similar to that conducted by my tenant You want to conduct such a business from the same premises for which he is paying me rent? You propose to place your clerks in the aisles of his store? You intend to use the fixtures installed at his expense, and maintained by him, for your purposes? You want to sell only the quick-selling articles with the larger profits? If this is your proposition, may I ask you where you expect to get your customers?"

The stranger answered, "Oh, that is the easiest part of it! I expect to sell to the customers and patrons of 'The Emporium.' Its business is old and well-established; the customers are already there. That is one of the strong features of my proposition. No advertising or tedious 'pioneering' will be necessary. I shall not handle any line that requires the slow and disagreeable process of building up to make profitable. Do you not see what a great advantage it will be to the customers of 'The Emporium?' With a double set of clerks—his behind the counters and mine in the aisles, on skates—they will be waited upon so much more rapidly."

"Well," said the landlord, "'The Emporium' pays me a good rent. I also receive a portion of the proceeds from the business, in addition to the rent. Where do I come in if I entertain your proposition?"

The stranger answered, frankly, "I do not expect to pay any rent! Why should I? The owner of 'The Emporium' is paying rent enough. I do not care to share my profits with you, but, as I said before, the people will be greatly benefitted—they will be waited upon much more quickly than heretofore."

The landlord asked, "What arrangement, if any, do you intend to make with the owner of 'The Emporium?' He furnishes fixtures, and he pays for the janitor service and expenses in connection with the store—how are you going to square the matter with him?"

The stranger said, "Why should I make any arrangement with your tenant, if you give me permission? You own the store. True, he furnishes the fixtures, and maintains them; but his fixtures, although paid for by him, belong to you, and they are ample for both of us. The janitor service? Shucks! Just forget it! He pays for that."

"Well," said the landlord, "It seems to me that your proposition would create interminable confusion and trouble. What DO you propose to do?"

"Listen!" said the stranger, magnanimously, "I will furnish the roller-skates, and the paper and string necessary to wrap up the articles which my clerks sell to the customers of 'The Emporium.'"

The landlord, like all true landlords, had the desire to get all that was coming to him, but withal was not unwise, and he reasoned with himself somewhat thusly: "If I allow this man to establish his 'Bazaar' and occupy the premises jointly with my tenant—what then? Will my rentals be increased? No! Will my income from the proceeds of the business of 'The Emporium' continue in the future as in the past? Most likely not, as his earnings will undoubtedly be diminished, as new and additional customers are not attracted. With the loss of a portion of the more profitable business, will there not be a rise in the price of the staple necessities and slow-selling articles? Will 'The Emporium' discontinue handling them? A failure to do so will not help the community. Possibly, 'The Emporium' will be forced into bankruptcy. Then I lose both rent and profits from the business. The claim that patrons will be waited upon more quickly, is questionable—confusion will be multiplied; and who is going to be benefitted?"

The landlord mused on: "'A bird in the hand is worth two in the bush.' Can I afford to even allow this man with his 'Bazaar' to come in and occupy another store? Peradventure he pays me a similar rent to that paid by my first tenant, and even though he gives me a share of the profits of his business, is the business of the community of sufficient proportions to warrant the establishment of another enterprise

*Adapted from a pamphlet, by J. A. Beeler, Gen. Mgr. Denver Tramway Company.

like 'The Emporium?' My tenant pays his rent promptly in advance. He pays his help good wages. He has conducted his business in a manner that gives general satisfaction, and his establishment is a credit to the community."

What did the landlord do? What would you do if you were the landlord?

The services of a Sherlock Holmes are not required to discern the presence of a dark object in the wood-yard. The time is now, and of course you have all discovered the fact that the municipality represents the landlord; the premises the city streets. "The Emporium" is the Tramway Company, and the rent is $800 per mile of single track (in Toronto) for the privilege of operating on the streets. The proceeds from its business paid the city are its percentages amounting to over one million dollars annually.

The Tramway Company, by the construction of its lines in and around the city in all directions, has greatly enhanced the value of city and suburban property. The long hauls may be likened to the staples and necessities sold at little or no profit, and have no attraction for the stranger with his "jitney" bus. He naturally prefers the more profitable, quick-selling articles—the shorter routes, with their heavier traffic. The "clerks in the aisles" are, of course, the chauffeurs operating their buses along the tramway routes.

The "jitneys," if permitted to operate over the same routes, by running ahead of the street cars, would pick up many of their passengers, and by escaping the responsibility of paying for franchise rentals, street paving, grading, viaducts, and other public burdens which have fallen to the lot of the street car companies, including the "janitor service," might make a nice living for a lot of freebooters looting the cream off the transportation business.

Speaking of "janitor service," the Tramway Company expends in labor and power every winter thousands of dollars for clearing the tracks from snow. Last winter the amount expended would probably buy a hundred "jitneys." "Forget it!" Of course, this is an embarrassing question to a "jitney" magnate who has bought a bunch of cheap autos at a dollar down and a dollar per. They are ready and willing to furnish the "paper and string," by paying the ordinary auto license, amounting to the magnificent sum of (in Toronto) one dollar per seat per year, to go to the general uplift of the community.

The city, as a landlord, wants and should have all it is entitled to, but many points are involved affecting present policy and future possibility. Is it fair to require a street car company to install and maintain paving, which the car company does not wear out, for the benefit of a "jitney" bus, which would wear it out? Is it fair for a street car company to pay for viaducts, subways, and other public improvements, and allow a line of buses to use them free of charge? Is it fair to expect a street car company to serve thinly settled districts at the minimum rate, with a free transfer, and give up the more profitable lines?

Here are a few facts that speak for themselves. In addition to the franchise and general tax, the Toronto company pays interest on some four million dollars of bonds that have been issued for street paving, grading, and other public improvements.

What gain is there to a community where the street car company is laying off skilled and carefully drilled men that earn good wages? Will not the community that permits the operation of this method of transportation suffer in the end?

Is it not more than probable that, with inroads being made into its more profitable business, the car company will have to curtail its service or face bankruptcy? Suppose, by way of illustration, that the street railway should cease to exist, and that the community was forced to rely on "jitneys" as the sole means of public transportation—would not your transit facilities be impaired? Would they be as convenient or as safe as under present methods?

Fully 85 per cent. of the expenditures of the tramway for combined construction and operations are made locally for home products, materials, fuel and wages. Exactly the opposite is true of the "jitney" buses. Fully 85 per cent. of their expenditures are made abroad for autos, tyres, gasoline, and repair parts.

The city of Toronto is taxing the jitneys $1 per seat per annum. Suppose there are 200 jitneys with an average of five seats—$1,000. To offset this item of revenue, the city will lose from the Toronto Railway Company its 20 per cent. on approximately $1,000,000, judging from the figures at present available. This is $1,000 to offset a loss of $200,000. So much for our civic financing. The moral aspect of the case, an item of sufficient importance to plunge Europe into a world war, is dismissed by our city council with a mere wave of the hand.

Remarkable Performance of Pennsylvania Railroad Locomotives

Some very interesting figures have just been given out covering the preformance of the electric locomotives used by the Pennsylvania Railroad on the Manhattan Division, operating passenger trains through tunnels entering New York City under Hudson River.

These locomotives have been in use for nearly four and one-half years, and the data given below represents their performance during the period in a very striking manner.

They were designed to start and accelerate a 550-ton train, in addition to the locomotive, on a 1.93 per cent. grade in tunnels, but in actual operation, 850-ton trains are frequently started on this grade, and trains of 14 all-steel cars, weighing over 1,000 tons, are handled without difficulty.

Each locomotive in service passes over an inspection pit every twenty-four hours, when a running inspection of machinery is made, similar to that given steam locomotives over the pit, and slight repairs made where necessary. The average time required for this inspection is approximately ten minutes.

After 3,000 miles run, the locomotives are taken into the shop for a general or periodic inspection, when all electrical apparatus is thoroughly gone over, tested, cleaned and necessary adjustments and renewals made to all electrical and mechanical parts.

The shopping of these locomotives for general repairs is governed by tire wear, and a number of locomotives have run from 90,000 to 112,000 miles before it was necessary to turn the tires or do any general repair work.

The general overhauling and repairing of these locomotives is done in one of the regular steam locomotive repair shops.

On November 28, 1914, these 33 locomotives had completed four years' service, and during that period the mileage made and detention record is as follows:

Locomotive-miles	3,974,746
Total Engine Failures	45
Total minutes detention to trains	271
Locomotive-miles per detention	88,328
Locomotive-miles per minute detention	14,667

During this period, 463,558 train movements were made, or an average of 1,300 movements per detention, due to engine failures.

At Manhattan Transfer, where the change is made from steam to electric locomotive, on trains to and from the

Pennsylvania station, the time allowed per schedule for making change, including necessary testing of air brakes, is four minutes; although the entire operation can be performed in three minutes, and has been done in two minutes.

These locomotives are articulated machines, each consisting of two semi-units permanently coupled together, each semi-unit having a four-wheel bogie-truck and two pairs of driving wheels connected by side-rods, the semi-units being permanently coupled together at the driving wheel end. The locomotive frames, trucks and running gear are similar in general character to the standard American type steam locomotive and the relation of the various working parts on the two semi-units is similar in location to two steam locomotives coupled back to back.

Each semi-unit is equipped with 2,000-horsepower motor connected to the driving wheels through a system of parallel rods and cranks with an intermediate shaft, and is fitted with unit switches, master controller, Westinghouse automatic and straight air-brake apparatus, electric headlight, pneumatically-operated whistle, sand apparatus and other items of lesser importance. The locomotive equipment is so arranged that in the event of one motor being cut out of service, the entire locomotive can be operated from the other cab with the remaining motor. The unit switch control permits two or more locomotives to be coupled and all to be operated from either end of any one cab. The semi-units are interchangeable, and if any two semi-units are separated, they can be combined with any other semi-units, as may be required in making repairs, or for other reasons. The controllers are fitted with four running notches, giving great flexibility of speed regulation, and permitting the most economical use of power during acceleration.

Each motor has a continuous rating of 1,000 and a maximum rating of 2,000 horsepower, or a total of 4,000 horsepower per locomotive. The motors are of the direct-current, field-controlled commutating-pole series type. The weight of each motor complete, including cranks, is 43,000 pounds. The motors are supplied with direct current at 650 volts from the third rail, through contact shoes, located on either side of each truck. The motors, control and the complete electric equipment was furnished by the Westinghouse Electric and Manufacturing Company, while the locomotives were built by the Pennsylvania Railroad in its own shops at Altoona.

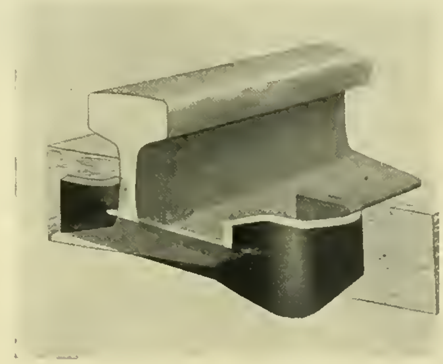
The rated tractive power of each locomotive is 66,000 pounds, but in actual service 79,200 pounds has been registered.

Weight and Dimensions

Weight of locomotive complete	156.5 tons
Weight per driving axle	49,750 lbs.
Total weight on drivers	199,000 lbs.
Weight on each truck	57,000 lbs.
Total length overall	64 ft. 11 in.
Rigid wheel base of each semi-unit	7 ft. 2 in.
Total wheel base of each semi-unit	23 ft. 1 in.
Total wheel base of each locomotive	55 ft. 11 in.
Total height of locomotive	14 ft. 8⅛ in.
Total height of cab	13 ft. 1-1/16 in.
Total width of cab	10 ft. 8¼ in.
Diameter of drivers	72 in.
Diameter of truck wheels	36 in.

The "Superior" Rail Anchor

An important requisite in rail anchors is that they must remain tight and operative at all times and under any condition of track or service without attention after application. The "Superior" rail anchor, illustrated herewith, is said to fulfill these requirements. This anchor is made of ⅜-in. heat-treated and oil-tempered steel with one end bent to form a spring, which rests against the side of the tie, and two lugs bent out on the upper edge of the anchor to engage the upper surface of the rail base when in place in the track, as shown in the accompanying illustration. The elasticity of the steel, of which the anchors are made, tends to prevent them from being loosened by vibration or by expansion or contraction of the rail. The device can be ap-



plied by an average trackman without other tools than a light hammer. When placed at right angles to the rail, the lugs can be slipped up over the edges of the base, after which the device is hammered tight. The holding power is dependent on the grip furnished by the reaction of the steel spring and the "shackle hold" secured by the wedging action of the lugs on the sloping surface of the rail base when the device takes its diagonal position across the rail. This rail anchor is manufactured by the Track Specialties Company, of New York City.

Canadian Electric Railway Convention

The members of the Canadian Electric Railway Association held their annual convention in Quebec this year, Mr. C. B. King, president, presiding. The mornings were given over to business sessions, the afternoons being left free to take in trips to the Montmorency Falls, to Ste. Anne de Beaupre, and over the local system. A most successful convention wound up with a dinner at Kent House, the palatial summer hotel of the Quebec Railway, Light, Heat & Power Company. The election of officers for the ensuing year resulted as follows:—

President, J. D. Fraser, secretary-treasurer of the Ottawa Electric Railway Company; vice-president, E. P. Coleman, general manager of the Dominion Power & Transmission Co.; secretary-treasurer, Acton Burrows; executive, the president, vice-president, secretary-treasurer, and the following: A. Eastman, general manager Windsor, Essex and Lake Shore Rapid Railway; H. M. Hopper, general manager St. John Railway Company; Wilson Phillips, superintendent Winnipeg Electric Railway; C. L. Wilson, assistant manager Toronto & York Radial Railway; A. Gaboury, superintendent Montreal Tramways; H. G. Matthews, general manager Quebec Railway, Light, Heat & Power Company; C. B. King, manager London Street Railway.

With the expiration of the Toronto & York Radial Railway Company's franchise on lower Yonge Street, the city promptly removed the rails from the street. The company issued an injunction, but were unsuccessful in having the work stopped. The Toronto Railway claim under their franchise to have the right to extend their Yonge Street line over this section and operate it as part of the city system. This will not be possible, however, until such time as the viaduct is completed.

The Dealer and Contractor

What the Cash Box Has for Me

By Harry C. Turnock*

We talk about our overhead costs with the pedal soft pedalled and the muffler double-muffled—and, by the same token, some of us evade the issue with triple extract of reverse English.

Can it be that some of us are afraid and others dassn't, probably due to the desirability of avoiding alleged ridicule, or due to the proverbial modesty becoming all electrical contractors?

The writer was not a little disappointed at the lack of intense criticism which was expected when he blossomed out with a dissertation entitled, "Overhead Expense," a year ago.

He did not expect applause from the grandstand; nix. He would have been content with vegetables and other utensils of questionable origin and merit from the bleachers.

The principal reason for this paper is designed to produce a lot of harsh words—but let's have them.

"Bill, switch off those lights and smoke up while I cogitate. As I was saying before, electrical contractors are great kidders, but they spend most of their time 'kidding' themselves. Now, don't get sore, Bill, because this is on you."

"Are you making as much money as you say you do? I caught you 'red handed' estimating a job and making a princely mark-up of 15 per cent. over labor and material costs. I heard you soliloquize thusly: 'Now, Bill, old boy, here is where you can make a killing. The stuff costs you $2,500 and the labor runs $1,800, $4,300 all told. Fifteen per cent. of $4,300 is $645, which is some profit, eh, Bill? Here is where we get that Ford for the wife, and all we've got to do this year is to get one of those kind of jobs every month.'

"Bill, old chap, I am going to let you in on some homely dope, which will knock your Ford into scrap wire barrel, and, verily, all the king's six-cylinders couldn't yank it out. Here is a regular three-phase-sixty-cycle submarine:

That $645 Does Not Contain a Cent of Profit. Nay! It Represents a Loss

"I am going to prove to you that your cost of doing business—and you say you will do $60,000 worth annually—is nearly 16 2/3 per cent., based on your gross sales, and if you are willing to accept a profit of 5 per cent. on gross sales, your overhead will be about 21.3 per cent., based on labor and material. Your year's business will look like this when resolved into component parts:

Material	$27,000.00
Labor	20,000.00
Overhead expense	10,000.00
Profit	3,000.00
Total sales	$60,000.00

"To prove that it is costing you $10,000 per year to engage in the contracting business, money paid out before you can dig into the cash box for anything for your wife, please allow me to divide your expenses into four factors:

(a) General expense.
(b) Office expense.
(c) Selling expense.
(d) Shop expense.

"These costs should be divided, because it is easier for analysis. Scrutiny means efficiency, and efficiency means Fords. Stop the leaks and cut the extravagances by scrutinizing a monthly 'overhead analysis' sheet. You cannot restrain yourself or your employees from spending money for unnecessary things unless you compare notes. First of all, prepare your budget or appropriation for each department, then analyze your costs on each trial balance day, so as to keep within the amount appropriated. But let us go on, Bill.

"General expense is the most important and often times the least considered of the four general factors of overhead expense, and here it is:

General Overhead

Salary—Manager's, Proprietor's, Officer's—	Yearly
Your salary	$1,800.00
Your partner (none)	
Total executive salaries	$1,800.00
Taxes—	
Real estate	None
Personal property	$ 25.00
Government income tax	None
State corporate taxes	None
Federal corporate taxes	None
Licenses (master electrician)	25.00
Total general taxes	$ 50.00
Insurance—Fire—	
Stock supplies	$ 5.00
Furniture and fixtures	5.00
Tools and instruments	10.00
Building	None
Total fire insurance	$ 20.00
Life and Accident—	
Your life	$ 60.00
Your partner's life	None
Accident insurance	20.00
Total life insurance	80.00
Liability—Bonds—	
Employees' compensation	$ 150.00
Bookkeeper, collector, cashier, master electrician	70.00
Total insurance	$ 320.00
Reserve for depreciation (tools, etc.)	$ 100.00
Reserve for depreciation (stock supplies)	$ 50.00
Reserve for depreciation (furniture and fixtures)	20.00

* In the National Electrical Contractor.

Reserve for depreciation (bad accounts)	300.00
Losses and Depreciation—	
Theft, fire, breakage, strikes, lawsuits, wear and tear, accidents, market fluctuations...	$ 100.00
Losses on contracts, allowances on sales, or contracts, maintenance of guarantee	$ 10.00
Solder account	5.00
Total losses and depreciation	$ 585.00
Interest and Discounts—	
Interest on loans	
Interest on past due accounts (you are lucky).	None
Discount on commercial paper	
Housing Expense—	
Rent	$ 800.00
Light and heat	240.00
Telephone service	80.00
Janitor	Free
Repairs to premises	None
Cost of moving	None
Total housing expense	$1,120.00
Miscellaneous Expenses—	
Donations to charity	$ 10.00
Christmas presents (employees)	20.00
"Civic pride" expense	5.00
Literature and books	20.00
General legal expense	15.00
Cost of organization (pro rata)	2.00
Total miscellaneous expense	$ 72.00
Societies, Associations and Conventions—	
National Electrical Contractors' Assn. dues ..	$ 10.00
State Association, dues	5.00
Local Association, dues	125.00
Engineering Clubs	10.00
Electrical League	5.00
Credit Men's Association	50.00
National, State and Local Contractors' Convention expenses	150.00
Total association expenses	$ 355.00

"Now, Bill, let's total up the sub-headings of general overhead expense:

Executive salaries	$1,800.00
General taxes	50.00
Insurance	320.00
Losses and depreciation	585.00
Interest and discounts	None
Housing expenses	1,120.00
Miscellaneous expenses	72.00
Societies and conventions	355.00
Total general overhead expense	$4,302.00

"You have expended 4,302 perfectly good 'iron men' for general expense, with three other very important divisions of 'overhead expense' to hear from.

"You may argue that there are various of the above items which should be charged to some other heading. They are not put there because they look nice, but because we must have them in some convenient place for our especial consideration. Bill, I would like to hear from you later on that solder item under depreciation and losses, and also life and liability insurance as an overhead item.

"Bill, the cash box does not contain quite as much as you thought it did. Your general expense is running about 7¼ per cent. of gross sales. Your office expenses, I will show you, will run about 3¼ per cent., sales expense about 3 per cent., and your stock and man handling departments will cost you a fraction over 3 per cent.

"You were estimating your jobs on a basis of something like a loss of $2,500 per year.

"Moral—Don't pull too many No. 0000 cables in ½ inch pipe."

Will You Attend the Convention?

The need of better and bigger organization among electrical contractors, to combat the adverse conditions under which the trade is operating, has long been evident. A move is again on foot to bring the contractors together at some central point and at some opportune time in the near future. It would appear that Toronto's central location makes it the most desirable point as an initial meeting place, and exhibition time seems the most likely to find a large number of contractors in this city. Added to this is the fact that Toronto electrical contractors are well organized and are willing to assume the burden of the work entailed in reaching the members of the trade at outside points and learning their attitude in the matter.

To this end the Secretary of the Electrical Dealers' & Contractors' Section of the Retail Merchants' Association is sending out letters to all contractors on their lists suggesting a convention in Toronto during Exhibition time. We believe the suggestion should, and will, meet the hearty support of all. The Secretary wishes it to be understood that the invitation applies to any dealer or contractor situated anywhere in Canada, whose opinion and co-operation will be welcomed. You are therefore requested to consider this an invitation to reply in case you should not receive a copy of the letter direct from the secretary.

It may be mentioned in passing that the expenditure entailed in this movement is being met so far by voluntary subscriptions on the part of Toronto contractors who are sufficiently convinced of the value of more thorough organization to place their money behind it. The letter being distributed is worded as follows:—

It has been suggested several times at meetings of the Toronto Branch of the Electrical Dealers' & Contractors' Section of the Retail Merchants' Association of Canada, Incorporated, that a convention of all electrical dealers and contractors be held in this city during Exhibition week for the purpose of taking united action on some of the questions confronting us today. A convention committee have been appointed to take this matter up with the trade and ascertain their views.

Would you be in favor of holding a convention in Toronto commencing Labor Day, September 6th next, and could you attend or be represented at such convention?

A great deal of good work has already been done to put the trade on a better basis, but we feel the need of the general support of the entire trade to effect much-needed improvements along the following lines:—

1. Revision of the Rules of the Hydro-electric Power Commission of Ontario for wiring installations.

2. Proposed licensing of electrical contractors, and their employees.

3. Consideration of our position under the Workmen's Compensation Act of Ontario. Copy of the Committee's

report on this subject is being printed for general distribution to the trade.

4. The conclusion of an arrangement with jobbers for the establishment of a fair scale of resale prices to consumers.

5. Adoption of some means for conveying to out-of-town members proceedings of Toronto meetings, reports of committees, etc.

6. To organize an active campaign to promote the use of electrical energy along all possible lines; to preach the doctrine "do it electrically," and to co-operate with manufacturers and supply companies along these lines.

We are addressing you for the purpose of getting your opinion on the subject of a convention, and the Committee will be obliged if you will note your reply on the enclosed postal card and return same promptly. If a convention is to be held there will be a great deal of work to be done, and prompt action is essential. Please understand that the proposed convention is for the entire retailing and contracting electrical trade, and is not restricted to any organization. You are in the trade, and you are vitally interested in any action we take as united electrical dealers on the questions above mentioned.

How to Wire a Dining-Room Table

Electricity in the home means, to a very considerable degree, electricity in the dining room. The convenience and cleanliness of electric cooking makes the preparation right on the table of at least the two lighter meals of the day, say breakfast and luncheon, economical, expeditious, and pleasurable.

One of the obstacles not easily overcome has been the supply of power at the same time to a number of utensils

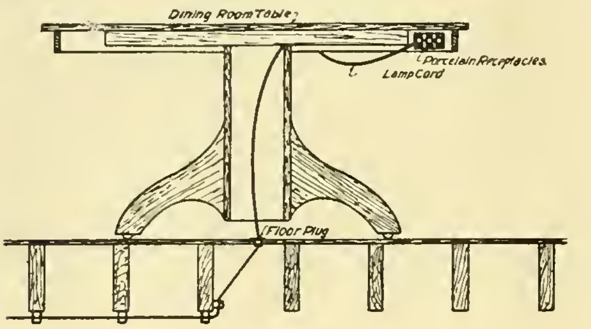


Fig. 1.

on the dining table. This is necessary, however, or there will be an uncomfortable delay—a factor which no doubt has played a very considerable part in the past in giving the impression that electricity is "slow."

There are now, of course, different devices on the market which enable one to feed current to more than one utensil from the lighting socket, but these at best are only provisional and are objectionable for different reasons. The lighting circuit is almost certain to be too small for power purposes, and the cord (or cords) is unsightly, inconvenient and in the way to an extent that may oftentimes be considered dangerous to limb and certainly to table ware. If the use of electricity in the dining room is to be developed to the

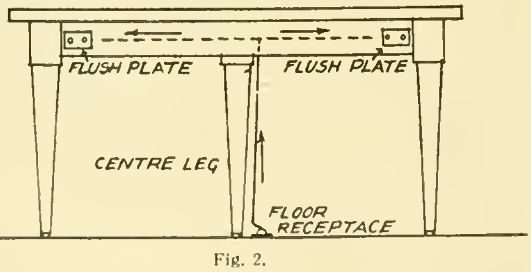


Fig. 2.

extent justified by its advantages, it would seem necessary, therefore, that a better method of current supply should be available.

The Society for Electrical Development is distributing folders describing a method recently brought to their attention. This is illustrated in Fig. 1 herewith, and is self-explanatory. Current is led by means of a flexible cord to one point of the table, where a group of three porcelain sockets was installed.

We believe, however, that a Canadian electrical contractor has recently completed an installation which is much more flexible than that shown in Fig. 1. This is described in some detail below and also illustrated in plan and section in Figs. 2 and 3.

A special power circuit is run in the basement to the centre of the dining room floor, terminating in a proper "floor plug." It will be noted, of course, in both these installations, that the work can be done about as easily in

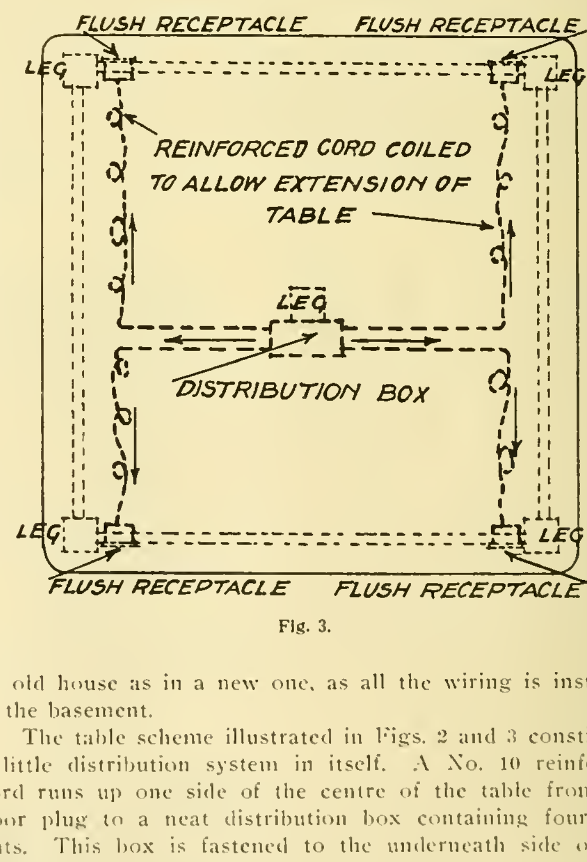


Fig. 3.

an old house as in a new one, as all the wiring is installed in the basement.

The table scheme illustrated in Figs. 2 and 3 constitutes a little distribution system in itself. A No. 10 reinforced cord runs up one side of the centre of the table from the floor plug to a neat distribution box containing four cutouts. This box is fastened to the underneath side of the table-top. From the distribution box four leads of No. 16 reinforced cord pass out to the four corners of the table somewhat as shown in Fig. 3, where each terminates in a flush receptacle. The receptacles in the corners are set into the apron of the table and so are neither in the way nor unsightly. In this particular case, the plates are finished to correspond very closely in color with the table and would not be distinguishable unless special attention were drawn to them.

The plug located at the floor line does away with all

obstacle to the moving of the table, as this can be withdrawn without inconvenience and replaced again when the table is returned to its normal location. Another feature provided for in this installation is in the "slack" allowed in the reinforced cord, as shown, which allows the table to be extended to its full length without in any way interfering with any of the electrical connections.

This distribution idea is, presumably, capable of extension to meet larger demands, though, as will be noted, the occupants of opposite sides of this table, supposedly the householder and his wife, have each of them two outlets at their immediate disposal, one each on the right hand, and on the left. Thus there can be operated at one and the same time percolator, toaster, bacon frier and egg boiler, or any other combination of four utensils that may suit the convenience of the household.

What is New in Electrical Apparatus

Lamp with Several Pairs of Carbons

Following is a description of the Quadruplex Lamp, manufactured in Canada by the Electrical Illumination Company of Canada, Limited, Montreal. The Quadruplex is a lamp with several carbon pairs in series or multiple enclosed in one globe.

It is very difficult on lamps switched in series to obtain a uniform voltage at the different arcs and a uniform length of same, the result generally obtained showing that the arcs vary in length, and that the light produced by lamps in series has consequently an unsteady intensity. Therefore, in the case of a lamp with several arcs, the first arc is overloaded, which causes too fast a consumption of the carbons; the second is almost equal, whereas, for example, the third arc has an insufficient potential.

In the Quadruplex Lamp the carbon holders are united to the magnet core, and brought into action by this core; they are intended to take a free initial movement, free of changeable amplitude prior to its grasping and lifting the carbons, and these have each a purview of advancement, operating through gravity and graduated in a proper manner, and in such a way that the carbons, the hold of which is brought into action through the initial movement free of weaker amplitude, possesses the strongest pressure of advancement.

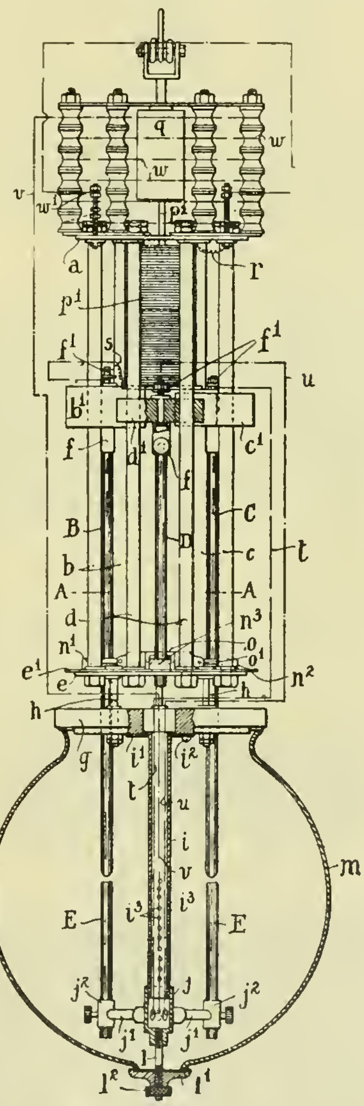
The lamp is equipped with several sets of carbon pairs Beneath an upper plate or headpiece, a, are fastened several pairs of vertical guiding shanks, b, c, d, e, fastened by their interior extremity to a plate, e, by screws, as represented. The plate e is isolated from the guiding shanks by a layer of a suitable insulating substance e^1. On every pair of shanks can slide a counterpoise or a crosspiece b^1, c^1, d^1, for the rising of the carbons, composed of a fireproof substance of strong insulating power and provided with sockets, f, for the carbons B, C, D, E and with posts f^1, to which the conductors are joined. The represented crosspieces b^1, c^1, d^1 have different dimensions and weights, which differ in a corresponding manner, the crosspieces d^1 and c^1 being almost equal to the half and the three-quarters of b^1 respectively.

At a little distance beneath the plate e a disc g of suitable fireproof substance is provided, fastened to this plate by screws and bolts, such as h, so as to save a space between the plate and the disc.

A central tabular organ i hung at the disc g is fastened to a plate by means of which it is kept in place through the medium of screw i^2. The interior extremity of this tube is supplied with a cap j, equipped with three radial tabular arms j^1, suitably isolated, the exterior extremities of which terminate in vertical sockets j^2 intended to receive the interior carbons E. l is an iron-pin, screwed into the lower part of cap j and by means of which a plate l^1 and an earscrew screwed to this iron pin, serve to maintain the globe m against the disc g.

On the upper side of the plate e are found carbon holders and each one consists of a rectangular piece of suitable metal, n^1, n^2, n^3, n^4, in which an opening has been made for the passage of one of the carbons, and these carbon holders are articulated by their interior extremity in o^1 to a mass of insulating substance O.

This pillar for the carbon holders is joined to the iron brace of the solenoids p^1 by the shank p^2, and the iron brace



The Quadruplex Lamp.

is joined at the upper part to the plunger of the regulating dashpot q.

The magnet core is by preference composed of laminated iron for the purpose of increasing its magnetic power and consequently improving its lifting power. The lamp can be burned on an alternating as well as a direct current. The action of the carbon holders is in differential amplitudes of the free initial movement. The operation is accentuated by

the different pressures to which the several carbons are advanced, and the arcs are uniformly maintained.

The tubular medium which carries the steady interior carbons is perforated or open, as shown, the upper part of the same passing out into the space between the plate and the disc in such a way as to establish an intercourse between the interior of the globe and the atmosphere. This tubular medium is provided with glass wool, which allows the free gas through the combustion of the carbons to escape from the interior of the globe. This glass wool is also an insulating substance.

The lamp is made for four pairs of carbons, but one, two, three or four pairs of carbons can be used as required, so that one lamp can be regulated for one, two, three or four thousand candle power. The light can be increased by burning flaming carbons of a double or triple amount of candle power. It is of the same construction and size throughout. After a certain time of burning one or two pairs of carbons on each feed, the new arc is started on the pair of carbons with the lowest resistance. On that account only two pairs of carbons are burning at one and the same time; the other pair is neutral to the next feed. Owing to the fact that the resting pair of carbons has the lowest resistance, it starts the different pairs of carbons burning at the intervals of the feed, which is an important factor in producing equal light.

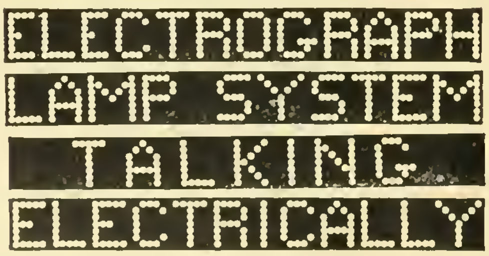
The lamp is an entirely new departure in arc illumination, and is patented in nearly every country in the world.

The Electrograph

The electrograph is an apparatus for communicating any desired message to a crowd of people, inside of buildings, halls or in the open air. This is done by means of electric light flashes on a field or bank of electric lamps, certain groups of lamps being lighted momentarily to form letters of a word or words, which in succession are visible and form the sentence desired. The device is a development of the electric sign flasher, employing a similar principle of operation, but being more compact and adaptable to a large number of uses for which the present so-called "Talking Sign" is scarcely available because of its high first cost and expensive operation and maintenance.

The electrograph "talks" graphically and automatically any desired number of sentences before repeating them. Its word flashes are easily read and produce a most effective result. The apparatus is furnished in many sizes and styles,

Lamp Bank and 4 successive Flash Indications in this Bank.

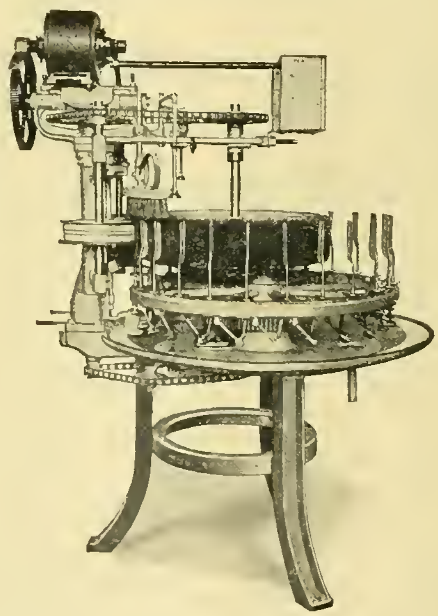


from the small window display attraction up to the largest open-air or roof sign. They are intended for publicity in general, as a medium for individual and collective advertising, as an indicator or annunciator of news items, information, commands, etc. The machinery controlling the device, being light and small, requires but little floor space and can be placed anywhere near the lamp-letter-field or lamp-bank, and may be concealed in various manners. The lamp-bank where the messages are visible can be with or without display in order to conform to the conditions surrounding the space where it is used. The text or message to be transmitted or communicated is first prepared in form of a stencil or record and then inserted in the machine. The preparation of the record is simple and easy. It is made with a special perforator for this purpose and permits unlimited variation of the reading matter according to need and occasion.

The distinctive character of the electrograph is that it talks to many people at a time who could not be reached successfully by loud-speaking telephones. If handled rightly it should prove to be a splendid money-maker when exploited in connection with general advertising talk in any locality or location placed. It is being marketed by the Electrograph Company, 53 West Jackson Boulevard, Chicago.

Electrically-Driven Bottle Washer

The device illustrated herewith is used for washing bottles of various kinds. It consists of a horizontal metal wheel with hollow rim and spokes which carry water under pressure into the bottles. At regular intervals it is fitted with hollow, rubber-webbed spindles over which the bottles are placed. As the wheel rotates the bottles are whirled around on the spindle by a belt which presses against them at one side. As the bottle rotates the rubber web wipes the inside



Washes 1440 bottles per hour.

while the outsides are operated upon by several brushes set so as to wash all external parts. A large cast iron pan under the wheel catches the waste water and conducts it to the drain pipe. The attendant simply puts the soiled bottles on the spindles and removes the clean ones. With one attendant this machine has a capacity of 1,440 bottles per hour. The outfit requires a floor space of 4 x 5 feet. It requires about 170 cubic feet of water per 10-hour day. It is equipped with a 1/4 horse-power Robbins & Myers motor. The machine is manufactured by Chas. Hamann, Port Chester, N.Y.

Hydro Inspection Department Announcement

The Electrical Inspection Department of the Hydro-electric Power Commission advises that:—"All new Code flexible No. 18 B & S cord bearing Underwriters' Laboratory labels, with a 1/64 in. minimum wall thickness, are approved for fixture wiring, whether twisted or single conductor."

Protecting Polyphase Motors Against Phase Failure and Reversal

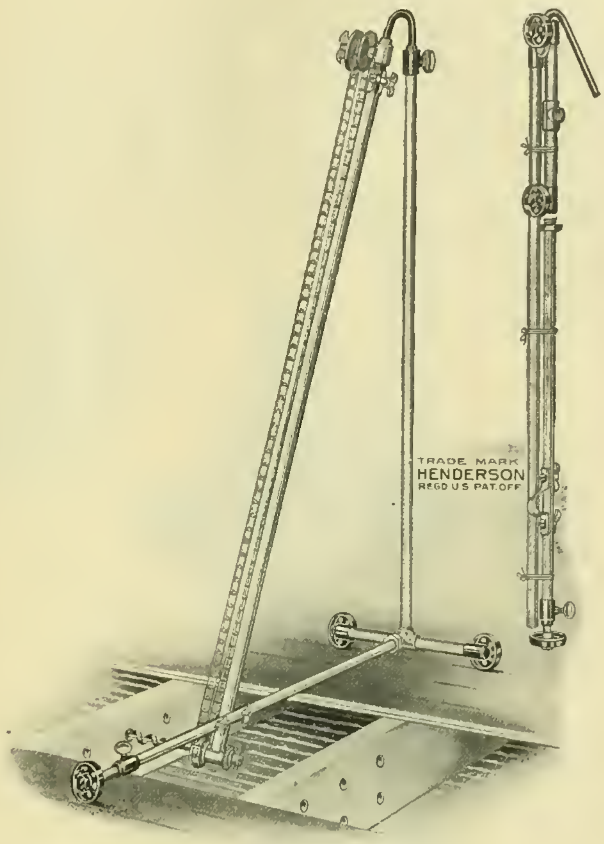
Accidental rotation of a motor in a direction opposite to that which the operator is expecting is often liable to result disastrously. An elevator may be dashed to the pit or through the overhead,—costly machines, pumps, cranes, hoists, etc., may be seriously damaged if the direction of rotation is unexpectedly reversed when the starting device is closed. With a.c. polyphase motors this may happen due to reversing of the phases and engineers have turned their attention to the problem of eliminating this source of accident. Failure of one phase may also cause burning out of the motor. A new type of phase failure relay, shown in the accompanying illustration, has been developed by the Cutler-Hammer Manufacturing Company, Milwaukee. This device is suitable for use on any system similar to a vertical motor starter. This phase failure relay provides against abnormal drop in voltage, against failure of one of the phases, and against reversal of the phases. If the supply voltage falls below about 70 per cent. of normal the relay opens the control circuit of the motor controller, and keeps it open until the line voltage returns to at least 85 per cent. of normal. These limits can be adjusted before shipment to suit special conditions. In case of phase failure, caused by the opening of one of the supply lines at any point, the relay opens the control circuit if the motor is under appreciable load, and keeps it open until the fault is corrected. If the load on the motor is very light, so that no harm would result from its running single phase on account of the phase failure, the device may not operate until the load is increased or the motor shut down. If the motor is at rest at the time of phase failure the relay will act immediately. Thus the motor is allowed to run as long as no damage can result. In case of phase reversal the relay opens the control circuit immediately and keeps it open until the phases are reconnected in the proper order. Accidents due to the motor running in the wrong direction when started up are avoided.

New Type Phase-failure relay

The electrical stores in Victoria, B. C., recently co-operated in an electric toaster campaign. The B. C. Electric Railway Company, Limited, arranged for the general advertising, etc., and all joined forces for a period of two weeks—15th to 29th of May—to popularize the toaster by means of window displays and demonstrations. The result was the sale of 72 toasters during the sale, which under general existing conditions must be considered fairly satisfactory.

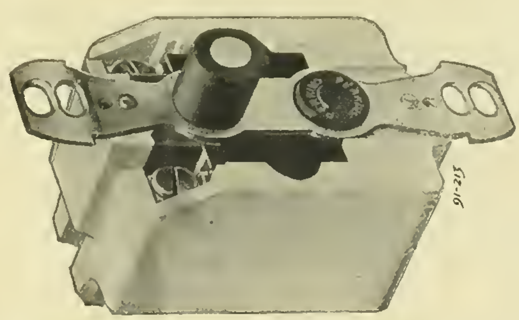
Attachment for joist boring machine

We illustrate herewith the floor joist attachment for joist boring machine being placed on the market by the Henderson Electric Company, Ampere, N. J. With this device holes may be bored easily and quickly in joists where the floor has been taken up. It is suitable for old and new houses, apartments and buildings of all kinds. Readily attached to any boring machine of this make; leaves both hands free to steady the machine and pull the chains. Adjustable for boring any distance below the floor line and for different width floor openings; and is collapsible for carrying.



Simple design two-button push switch

The Perkins Electric Switch Manufacturing Co., Bridgeport, Conn., have put on the market a new two-button push switch of simplified design and construction, which is known as the "Capax" switch. Every part is claimed to be substantial and mechanically correct. While the action is positive and quick, the movement of the buttons is less than seven-sixteenths of an inch—the out-button projecting only one-



half an inch beyond the face plate. A fibre shield, protecting the entire mechanism from dust and dirt during and after installation, and until the face plate is applied, is permanently secured in position by the supporting yoke. The switch is rated 10 amperes, 125 volts; 5 amperes, 250 volts; National Electrical Code standard and labelled.

Insulator with high flashover

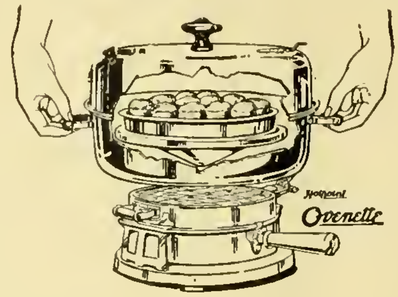
The boron silicate insulator shown in the accompanying illustration is manufactured by Fred. M. Locke, of Victor, N.Y. This new material is an aluminium silicate body, fused together with boron at a very high temperature and formed into shape, making a glass-like body, which is next to fused silica in its coefficient of expansion. It is claimed that the addition of boron to this body gives to the compound the property of retarding the ionization of the air around the insulator and thereby increases the arcing voltage by 50 per

cent.; also, that it makes this body more resilient to mechanical strains, and increases its dielectric strength 50 per cent. above porcelain. The dielectric constant of this new compound is 4.8, as compared with 6.5 for porcelain, and 8 for glass. Its specific gravity is 2.26, and its coefficient of expansion is .0000035. It is claimed that these insulators are valuable for service under great changes of temperature, fog, dust, lightning flash-overs, and very high frequencies. They will stand a temperature change from below zero to the boiling point of water without breaking.

Canadian Vickers, Limited, 20 Bleury Street, Montreal, have been awarded a contract by the city of Winnipeg for one Vickers 150 kw. inductive motor-generator exciter set, together with starting equipment. The plant is to be installed at the Point du Bois power house.

Small Portable Electric Oven

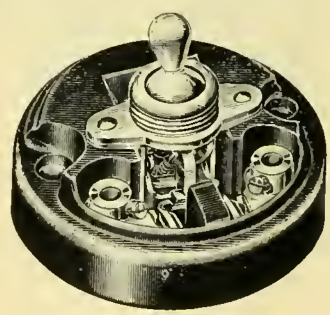
In the accompanying illustration is shown a small oven developed by the Hotpoint Electric Heating Company, Toronto, for use with their electrically-operated "El Glostovo"



and "El Grilstovo," both of which are of the glowing-coil reflector type. The device is called an "ovenette," and is of seamless sheet steel finished in nickel. It is being made in three sections as shown, which make it adaptable to two sizes.

Quick "Make" Tumbler

We illustrate below a new quick "make" and "break" tumbler switch, 5 amp. capacity, being placed on the market by J. H. Tucker & Company, manufacturers of electric light and power accessories, Birmingham, England. There has long been a demand among contractors and engineers for a switch having quick "make" as well as quick "break," and



the manufacturers claim that this switch fulfils the requirements. Micanite is used throughout for insulation, and the bases are of highly vitrified porcelain. The manufacturers state that the movement of this particular switch has been mechanically operated on test over two million times without breaking down.

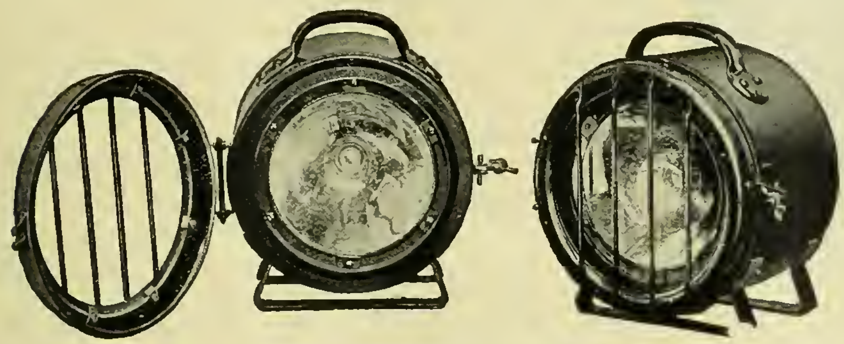
Another Hubbell Socket

The illustration herewith represents porcelain keyless socket No. 3375, manufactured by Harvey Hubbell, Inc., Bridgeport, Conn. This socket is built along the lines of an electrolier socket, providing a compact and practical porce-

lain unit for use on fixtures where a porcelain socket covering is desired. The manufacturers claim that wiring connections can be easily and quickly made, because of the special design of the interior.

Electric Headlamps for Mine Locomotives

The electrically operated headlamp shown herewith consists essentially of a metal case, a 7-in. mirrored-glass reflector and a tungsten lamp which is so suspended that the constant "pounding" of mine-locomotive service, for which the device is designed, will not break the filament. The manufacturers assert that the headlamp is practically dust-proof and watertight. The total weight of the device is 13 lbs. All metal parts are of drawn sheet steel, electrically welded and finished inside and out in baked black enamel. Handle and supports are provided as shown, and use is made of a grid door to prevent front-glass breakage. The "golden glow" lamp, as it is called, is particularly adapted for use where glare or dazzling light is to be avoided. It is claimed

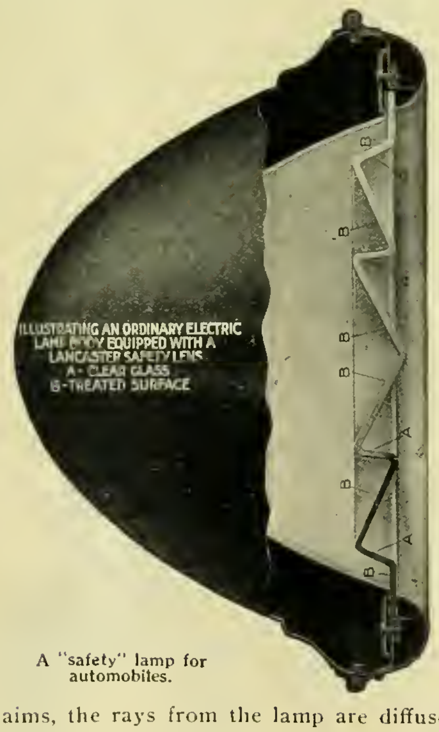


Throws light ahead 600 feet.

that with a 23-watt lamp a man can be seen on the track more than 425 feet ahead, and with a 36-watt bulb 600 feet ahead, of the locomotive. The headlamp is being made by the Esterline Company, Indianapolis, Ind.

Non-Glare Lens for Electric Headlamps

A safety lens, as it is called, for electric automobile headlamps, which is placed in the lamp in exactly the same way as an ordinary front glass, is shown herewith. The glass is recessed as shown, the depressions being of clear glass and the other parts of treated glass. As a result, the manu-



A "safety" lamp for automobiles.

facturer claims, the rays from the lamp are diffused in such a way that no glare is produced. The rays passing through the clear glass are deflected, it is explained, to the side, while the direct rays pass through the translucent glass. The device is being placed on the market by the Lancaster Lens Company, Lancaster, Ohio.

A New Type of Vacuum Cleaner

We show in the accompanying illustration a little electric cleaner of new design that is not only radically different in appearance, but for which the manufacturers claim many advantages and exclusive features. Probably the most noticeable departure is the new method of mounting the motor up on the handle instead of directly above or behind the cleaning tool. This method of construction dispenses with all wheels and casters, and makes possible the use of a renovator or cleaning nozzle that will go easily under radiators or heavy low furniture. Another advantage is the swivel joint at the bottom which permits the handle to be dropped to either side (even to the floor, if necessary) so as to get away back under beds, davenports, buffets, etc., without

Motor mounted on handle.

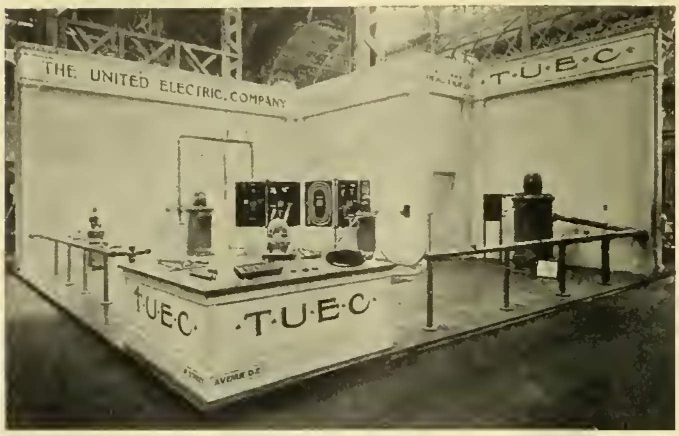
tipping the cleaning tool from a level position. It is claimed to be easier to adapt this cleaner to different kinds of work than any other on the market. A small felt strip for polished floors and a brush strip for rough floors may be instantly snapped into place in the aperture of the cleaning tool and as quickly removed with no other changes or addition of any extra adapters. A further advantage claimed in the design of this cleaner is that it provides a direct passage for the inrushing air to the centre of the fan and discharges it radially all the way around the outside. This cleaner is manufactured and marketed by the Santo Manufacturing Company, Twenty-first Street and Allegheny Avenue, Philadelphia, Pa.

Five salesmen of the Simplex Electric Heating Company, of Cambridge, Mass., were awarded prizes recently in New York, by the "Rice Leaders of the World Association," as a recognition of special skill in salesmanship.

The annual convention of the National Electrical Contractors' Association of the United States is being held in San Francisco July 21st to 24th. An important program has been arranged.

Tuec Exhibit at the World's Fair

We illustrate herewith the San Francisco exhibit of the Tuec Vacuum Cleaner. This exhibit is attracting very considerable attention among large householders, who are beginning to see that, in the removal of dust and dirt, as in so many other household operations, the most sanitary, convenient and economical way is to "do it electrically."



Tuec exhibit at the World's Fair, San Francisco.

New Interchangeable Plug Caps

Harvey Hubbell, Inc., Bridgeport, Conn., have recently placed on the market two new plug caps, which we illustrate herewith. The caps differ from others of this company's manufacture in the arrangement of strain relief. Both the caps are interchangeable with the entire line of Hubbell wall and flush receptacles.

Fixtures for Nitrogen Lamps

The illustrations of nitrogen fixtures herewith represent types recently placed on the market by the Canadian Tungsten Lamp Company, of Hamilton, Ont. These are made of brass or copper, according to specifications, are sold with or without fire-glazed enamel reflector, and are claimed by the makers to be the most efficient unit for half-watt lamps on the market. The small interior hanger illustrated is made to accommodate either 6-inch, 8-inch or 9-inch glassware, and may be had in any of the following finishes:—statuary bronze, empire bronze, black enamel, brushed brass, or nickel.

The Right Way to Do It

The Traymore, the new Atlantic City hotel, claimed to be one of the most luxuriously equipped in the world, is fitted with 2,800 plug receptacles (Chelten type). As the capacity of the Traymore is 1,400, this means an average equipment of two receptacles for every guest.

The Montreal Division plant employees of the Bell Telephone Company have formed an association for mutual improvement from which much good is likely to result. The association is made up of sections from the various city exchanges. These sections, having similar work and interests, meet twice a month for lectures and discussions. Each section elects two representatives to a general Board of Directors. This governing Board meets monthly for administrative purposes. General meetings of all the sections both for educative and social purposes are held from time to time, and altogether it is aimed to cover the whole field of Plant Employees' interests.

The "General Electric Review" has published a very interesting supplement to its July issue, covering the complete electric equipments of the Panama Canal, both during construction and in operation.

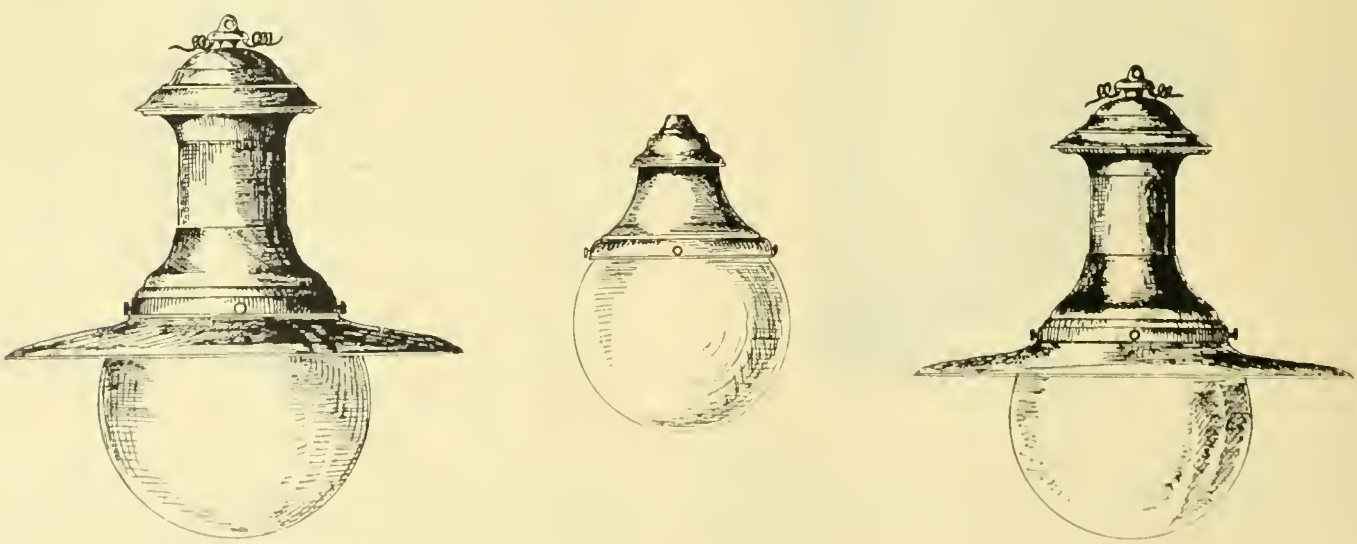
The Solex Company, Limited, importers and jobbers of electrical supplies and fixtures, have moved to 762 St. Lawrence Boulevard, Montreal. Mr. J. E. Pelletier, the manager, has just returned from a trip to the industrial centres of the United States, where he secured several excellent agencies.

Personal

Mr. J. T. Patton, for many years local manager of the Bell Telephone Company in Brockville, has been promoted to be manager at Sarnia.

Dr. C. P. Steinmetz has accepted the position of president of the Illuminating Engineering Society of the United States. Dr. Steinmetz's writings on various phases of illumination are recognized as classics.

Mr. A. M. Gray, assistant professor of electrical engineering at McGill University, has resigned, having been appointed head of the electrical engineering department of Cornell University. Professor Gray has done excellent work at McGill, especially in relation to electrical motors and wireless telegraphy.



New fixtures for Nitrogen Lamps manufactured by the Canadian Tungsten Lamp Company, Hamilton.

Current News and Notes

Ailsa Craig, Ont.

The hydro by-law carried on Monday, June 28th, by a majority of 126 to 5.

Brantford, Ont.

It is said a contract has been closed with Mr. Martin N. Todd, manager of the Lake Erie & Northern Railway Company, and of the Galt, Preston & Hespeler Railway Company, for the purchase of a part of the Grand Valley system between Paris and Galt. The price mentioned is $26,000 and is contingent on the electrification of the Lake Erie & Northern Railway between Port Dover and Brantford.

Brockville, Ont.

The City Council of Brockville have passed a by-law to construct a line into the Township of Elizabethtown, for the supply of light and power.

Calgary, Alta.

The Calgary Power Company continues to report remarkable increases in earnings. The May statement shows a gain of 43 per cent. in gross and 55 per cent. in net. For the five months of the present year, gross earnings are 27 per cent. and net earnings 47 per cent. higher than for the same period a year ago.

Edmonton, Alta.

The city of Edmonton recently imposed a fairly stringent regulation on the jitneys operated in that city. This included the requirement of a $5,000 accident policy and a license fee of $10 for each seat space of 18 inches. The Jitney Association appealed to the courts against what they termed unreasonable discrimination, and Justice Harvey upheld their claim as far as the license fee was concerned.

Harrison, Ont.

The town council are submitting a by-law to the electors on Monday, July 19th, asking authority to enter into an agreement with the Ontario Hydro-electric Power Commission.

Ingersoll, Ont.

The Ingersoll Telephone System has now over 1,200 subscribers and switchboard capacity to accommodate another 400. The rates charged by this company are as follows:—town subscribers, 4 party line, $12.50; single line, residence, $15, business, $20; rural, 8 to 10 party line, $15.

Kincardine, Ont.

The Water & Electric Light Commission will purchase 44 nitrogen-filled street lights to replace 18 arcs at present in operation.

London, Ont.

The London & Port Stanley Railway was opened for traffic, electrically operated, on July 1st. The official opening will take place on the 22nd of this month. Sir Adam Beck is reported as stating that the cost of the electrification of this line has been within $100,000 of the estimate.

The city is unable to come to terms with the Bell Telephone Company regarding the rental to be paid for an exclusive franchise in the city of London. A number of aldermen are strongly in favor of a municipal telephone system.

Montreal, Que.

The contract for installing an electrical fire alarm system, supplies of cable, etc., on parts of St. Catherine Street and Park Avenue and on Bleury Street, for the city of Montreal, described in our last issue, has been awarded to the Northern Electric Limited, Montreal. Work will be commenced at an early date. The price of the contract, which includes the entire equipment, is $47,955.

The Montreal Board of Control have awarded to G. M. Gest, Limited, Montreal, the contract for the construction of 2,000 feet of underground conduit, with branch lines to outside lamp posts along the main line of conduit, in connection with the filtration plant now being constructed.

Permission has been given by the Quebec Public Utilities Commission to the Laval Electric Company to carry its transmission line through the streets of the parish of St. Elzear, upon condition that the company supply light and power to the municipality and residents upon the most favorable terms granted by the company. All questions regarding the location of the line and its erection and any difficulties that may occur will be adjusted by the Commission.

The Quebec Public Utilities Commission, sitting in Montreal on June 15, approved of the general layout of further underground conduits, plans for which have been prepared by the Electrical Commission, reserving the consideration of the details for a meeting to be held on July 6. These plans were for Section No. 6, St. Lawrence Boulevard, between Craig and Sherbrooke Streets; and Section No. 7, bounded by St. Lawrence Boulevard, Notre Dame, McGill and Commissioner Streets. At a previous sitting objection was raised to the work on the ground that financial conditions were unfavorable, but the Commission held that they had nothing to do with this, their authority being limited to the approval and modification of the plans and specifications.

Niagara Falls, Ont.

Mr. Paul A. Schoellkopf, of the Hydraulic Power Company, is interesting himself in a scheme of permanent illumination of the Falls. Mr. Schoellkopf has just returned from the San Francisco Fair and states that he will use his influence to have the searchlight plant now used at the Fair removed to Niagara Falls, as soon as the Western exhibition is closed.

North Vancouver, B. C.

The solicitor for the district council of North Vancouver has filed a writ in the Supreme Court demanding that the entire lighting plant and equipment of the Vancouver Power Company within the district be handed over at a price to be named by arbitration.

Judgment was reserved by Mr. Justice Murphy in the action brought by the district of North Vancouver to compel the Vancouver Power Company to sell its franchise and plant in that district to the municipality. The company is unwilling to sell.

Orillia, Ont.

The Water, Light and Power Commission have closed a contract with the Standard Chemical Company, of Longford Mills, for a supply of 200 electric h.p.

Owen Sound, Ont.

The contracting firm of Grier & Lethbridge have been awarded the contract for the construction of the transformer station in Owen Sound, in connection with the distribution of power soon to be received from Eugenia Falls.

Okotoks, Alta.

The North Western Engineering & Supply Company, Limited, Calgary, have been given a franchise by the town council of Okotoks to install an electric light plant. Gas

engine power will be used and the plant will be up-to-date in every particular. Installation will commence at once.

Prince Albert, Sask.

Operations have been commenced on the construction of a rural telephone system covering the district south of the city. It is intended that ultimately this system shall cover a district of about 200 square miles. The operations are being carried out by the South Prince Albert Rural Telephone Company, which was originally operating in this district. The contract for the work has been let to the North Saskatchewan Telephone Development and Construction Company. The line is purely a farmer's telephone system, and among the towns it will touch will be included Davis, Clouston, MacDowall and probably St. Louis.

Regina, Sask.

The Canada West Electric Company, Limited, of Regina, Sask., recently secured the contract for the supply of telephones and other material for the two largest jobs which have as yet been let in Saskatchewan, namely, the Unity Rural Telephone Company and the Viscount Rural Telephone Company. This company are agents for Kellogg telephones. The Canada West Electric Company report that business in the telephone line has been very good, and that the prospects are very promising.

Smithville, Ont.

A by-law was submitted on July 3rd, authorizing the necessary expenditure for an electric lighting system for this village.

Toronto, Ont.

It is estimated that there will be approximately 60,000 lamp globes used in the lighting scheme of the Canadian National Exhibition this year.

Vancouver, B. C.

Delegates to the National Electric Light Association Convention in San Francisco recently passed through this city to the number of 150. A banquet was held in the Hotel Vancouver and the delegates were later entertained by B. C. E. R. officials. The hosts also included among their number Mr. R. F. Hayward and Mr. MacNeill, of the Western Canada Power Company; Messrs. Pim and Wright, of the Canadian General Electric Company, and Mr. Read, of the Canadian Westinghouse Electric Company.

The Canadian Northern Railway telephone line has been completed to the coast, final connections being made a few days ago through Yellowhead Pass.

Welland, Ont.

A by-law will be prepared and submitted to the next meeting of council, authorizing an issue of debentures to the amount of $3,500, to cover the extra expenditure necessitated by requests for additional power supply.

The Stamford Board of Trade, at their last monthly meeting, passed a resolution asking the government to buy out the telephone system on a basis of physical valuation and operate it at cost. Copies of this resolution are to be sent to every board of trade in Ontario, asking them to forward the same resolution to the government. A committee was also appointed to wait on officials of the Welland County Telephone Company and ask for an extension of their line into that county.

Winnipeg, Man.

The Board of Control has confirmed the appointment of Mr. Sanger as acting superintendent at the generating station at Point du Bois.

The Aeroscope at the Panama-Pacific Exposition

One of the most astonishing of the amusement devices installed at the Panama-Pacific Exposition at San Francisco is one which raises its passengers to an elevation of 330 ft. above the sea level and provides a sea horizon of 200 miles. This is called the Strauss Aeroscope and it is reported to be the largest passenger-carrying machine ever built. However, on a smaller scale it would be peculiarly adaptable to ordinary amusement parks.

The device is fundamentally a Strauss trunnion bascule bridge mounted on a revolvable tower. The tower in turn is mounted on a series of eight trucks which travel on a circular railway track 60 ft. in diameter, four of the trucks being provided with 15 h.p. motors and trains of gears to drive them in either direction. At the apex of the tower, 48 ft. above ground, are mounted two 15-in. shafts, or trunnions, and upon them the huge arm of the structure is mounted. This projects 200 ft. in front of the trunnions and 38½ ft. behind them, the rear end carrying a 380-ton counter weight that is made of reinforced concrete. The rear end of the arm is provided with two circular racks which are engaged by pinions driven by two 11 h.p. motors, and these raise or lower the arm as desired. The arm is provided also with two air propellers mounted near the end. These propellers are driven by a 3 h.p. motor and they assist in raising the arm and in steadying its motion.

As an amusement device pure and simple, the Aeroscope is unique. The tower and its car are brilliantly illuminated at night and as the lines of the structure are graceful throughout it is particularly inspiring after dark. It moves majestically, each trip consuming ten minutes, and the view afforded from the car is unparallelled. The total capacity per day approximates 6,000 passengers, and during the first four weeks of the exposition the Aeroscope carried 65,000 patrons.

Lighting Schedule August, 1915

Courtesy of the National Carbon Company, Cleveland

Date	Light	Date	Extinguish	No. of Hours
Aug 1	7 40	Aug 1	11 40	4 00
2	7 40	3	0 00	4 20
3	7 40	4	0 40	5 00
4	7 40	5	1 10	5 30
5	7 40	6	2 00	6 20
6	7 40	7	2 50	7 10
7	7 40	8	3 50	8 10
8	7 40	9	4 20	8 40
9	7 30	10	4 20	8 50
10	7 30	11	4 20	8 50
11	7 30	12	4 20	8 50
12	7 30	13	4 20	8 50
13	7 30	14	4 20	8 50
14	7 30	15	4 30	9 00
15	7 30	16	4 30	9 00
16	7 20	17	4 30	9 10
17	7 20	18	4 30	9 10
18	7 20	19	4 30	9 10
19	10 30	20	4 30	6 00
20	11 40	21	4 30	4 50
22	0 50	22	4 30	3 40
23	2 10	23	4 30	2 20
24	No Light	24	No Light	
25	No Light	25	No Light	
26	No Light	26	No Light	
27	7 10	27	9 10	2 00
28	7 10	28	9 40	2 30
29	7 00	29	10 00	3 00
30	7 00	30	10 30	3 30
31	7 00	31	11 10	4 10

Total Hours............ 170.5

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Vol. 24 Toronto, August 1, 1915 No. 15

The West—Present and Future

We are too apt to judge the prosperity of any locality by the number and magnitude of its real estate deals. Measured by this standard Western Canada is not so prosperous as in the immediate past.

But, real estate aside, which incidentally gives us an opportunity of sizing up the situation from other and more important points of view, the outlook in the west of Canada, we are convinced, is very satisfactory. It is true there is comparatively little construction work under way,—electrical or otherwise,—for the simple reason that the average municipality has been looking ahead a number of years and has already builded for a future development which is, for the moment, retarded. This has its bright side, however, as it means that foundations are laid in many of the cities and towns of Western Canada in readiness for increases in population and industrial activities of various sorts,—conditions which must be met in the course of the next two or three years at most. And these foundations are, for the most part, well laid. If the operating and maintenance charges of our Western utilities can only be met for a limited time by a little extra exercise of the British characteristic of "holding on," these municipalities will find themselves, without further expenditures, ready equipped to meet the expansion that has been delayed,—not so much by the war as by the natural and inevitable backward swing of the pendulum. The effect of war will, we believe, be much more in evidence in the return swing, which will carry the orders which new industrial conditions, favorable to Canada, must bring. These inevitable conditions will gain further impetus from the excellent advertising Canada is getting in this war, and the improved industrial organization which the war has called into existence. Thus, the fact that the West is "over" built, a matter of regret at the moment, will be a strong card to play in the game of population and industrial competition, which must immediately follow, if it does not precede, the ending of the war.

* * *

For the immediate future it is not easily possible to over-estimate the influence of this year's grain crop, the superiority of which now seems assured, both as to quantity and price. The moral influence of a good crop will also greatly assist not only the West, but other provinces of Canada, to say nothing of the Mother Land, in further stiffening our backs for the fight. Confidence, shaken somewhat by the 1914 crop at a time when optimism was difficult under the best of conditions, will be restored. With a foundation already built for many years' expansion, wonderful natural resources and attractions, and the western optimism restored to its full glory, who can doubt what the next decade has in store for our prairie west.

* * *

And the latest reports, now late enough to give confidence that all is going well, give evidence that we can look for record crops practically all over Western Canada. Wheat is estimated to occupy this year a total area of 12,896,000 acres, which is more by 1,662,500 acres, or 14.8 per cent., than the area sown for 1914, and more by 2,602,100 acres, or 25 per cent., than the area harvested in 1914, the area sown for last year having been reduced by 939,600 acres, the estimated aggregate of total failures through the winter-killing of fall wheat (211,500 acres) and through drought affecting spring wheat (728,100 acres). Not only is the wheat area this year under the double stimulus of patriotic impulse and high prices, 25 per cent. in excess of last year's harvested area, but it is also the largest area ever sown to wheat in Canada. As previously reported, the area to be harvested of fall wheat is 1,208,700 acres, the balance of 11,687,300 acres having been sown this spring. Every province shows an increase in the wheat area though it is the three northwest provinces which preponderate in the national effort to produce more wheat. The total area sown to wheat in these provinces is 11,659,700 acres, an increase over last year's harvested area of 2,324,300 acres, or 25 per cent. In Manitoba the area is 3,166,900 acres, an increase of 21 per cent.; in Saskatchewan it is 6,642,100 acres, an increase of 24 per cent., and in Alberta it is 1,850,700 acres, an increase of 35 per cent. Rather more than half of the total wheat area of Canada is in the single province of Saskatchewan. Oats are estimated to occupy a total area in Canada of 11,427,000 acres, an increase over last year's harvested area of 1,365,500 acres, or 13 per cent.; barley 1,518,400 acres, as compared with 1,495,600 acres last year, rye 106,440 acres against 111,280 acres, peas 189,470 acres, compared with 205,950 acres, mixed grains 453,000 acres, against 463,300 acres, hay and clover 7,788,400 acres, against 7,997,000 acres and alfalfa 94,480 acres against 90,385 acres.

* * *

And in all human probability the price of what the farmer has to sell will be higher than in past years. While we may look confidently for the forcing of the Dardanelles and the release of the Russian crop, this can only relieve the abnormal conditions among our belligerent allies to a degree, and doubtless everything Canada can produce will find a ready and profitable market. This will mean that the farmer will have considerably more money to spend than in any previous year, and this, it goes without saying, means that the wheels of general commerce,—retail, wholesale and manufacturing,—will be well greased. Take the item of wheat alone. The western farmer's 1914 crop, placing the yield at 140,000,000 and the price at 54 cents, gave him $75,000,000 to spend. This year a yield of 200,000,000 (1913 was over 195,000,000) might conservatively be expected. At even 75 cents this places

$150,000,000 in the farmer's hands from wheat alone,—just double last year's yield.

And after all the most hopeful factor in the western situation is the attitude of western men. We have received many letters from various points during the past month and almost invariably they speak with full confidence of present doings and future prospects. We print a number of them in this issue. These, with various descriptive articles on work either recently completed, under way or in immediate prospect, surely give a true portraiture, if chiefly from an electrical viewpoint, of things as they are. After reading these letters and articles, it is not possible to believe otherwise than that Western Canada has wonderful potentialities in men and resources, which find their best development under the most trying circumstances.

Whose "Mortal Peril?"

Speaking editorially on the value of the United States Naval Advisory Board for the Bureau of Invention and Development, the Electrical World uses the following words:

War has developed acute need for mechanical work in meeting new and startling conditions. The terrible struggle now going on is unique in that it combines the ferocity of medieval warfare with the last refinements in implements and methods of destruction. However one may regret the necessity it is perfectly obvious that in any future war it must be a case of fighting fire with fire and meeting each new terror with a response even more destructive. Under sea, and in the air, with shells, machine guns and deadly gases the United States cannot afford to be behind Europe on pain of mortal peril at no distant date. Under present conditions of "civilization" the nation that neglects to meet every destructive possibility of warfare promptly and efficiently will assuredly pay the penalty of negligence.

We in Canada, and we believe the same can be said of our European allies, have wondered at times whether the United States appreciates the seriousness of the barbarous war that has been thrust upon us and, to use the words of the article, the "mortal peril" in which the defeat of the allies would place the United States quite as much as any of the countries actually engaged in the conflict. If they do really understand that this is not a war for Europeans only, but a war against mortal perils and a world-wide return to medievalism, it is difficult to understand, for us, how the American nation can stand idly by and see the dangers which threaten their existence warded off by others. The Electrical World has evidently reached that stage at least where they appreciate the necessity for immediate defensive action in the interests of self-preservation.

Advertising Canada

The Dominion Government has arranged to have the water power resources of Canada conveyed in the best possible manner to the delegates who will attend the International Engineering Congress at San Francisco, next September. Two technical papers setting out in detail the engineering and industrial aspects of water power development, have been prepared by Lieutenant-Colonel C. H. Mitchell, one of the consulting engineers to the Dominion Water Power Branch. Arrangements are being made to have these papers supplemented by a discussion during the Congress by eminent Canadian authorities on water-power matters.

In addition to the two technical papers to be prepared for the International Engineering Congress arrangements have been made for the publication of several monographs on the water powers of the various provinces.

The water powers of British Columbia are being dealt with by Mr. G. R. G. Conway, the well-known chief consulting engineer to the British Columbia Electric Railway Company, of Vancouver, B. C. The water powers of the Prairie Provinces have been written up by Mr. P. H. Mitchell, consulting engineer, of Toronto. The water powers of the Province of Ontario have been described by Mr. H. G. Acres, chief hydraulic engineer of the Hydro-electric Power Commission of Ontario. Quebec water powers have been described by Mr. F. T. Kaelin, assistant chief engineer of the Shawinigan Water and Power Company. Mr. K. H. Smith, engineer of the Nova Scotia Water Powers Commission has covered the water powers of the Maritime Provinces. These five monographs have been prepared expressly for distribution at San Francisco.

Canada is generally recognized as one of the foremost power producing countries of the world. Her numerous rivers have immense potentialities, and within the area of population reasonable to be anticipated in the near future, is estimated to have water power possibilities aggregating 18,000,000 horse-power, while nearly 2,000,000 horse-power of this amount has already been developed. Comparison with other countries establishes our standing among other industrial nations; power development on such a scale is significant of corresponding industrial activity. It is notable that many of the foremost hydraulic advancements in water power engineering have found their application, if not their inspiration in Canada. Several of the largest power plants in the world have already been constructed and the many hydraulic plants, approaching two million horse-power in aggregate capacity, have permanently established markets, while over eight times this amount is within reasonable zones of commercially economic development.

In view of the fact that funds for the extension to present developments or for the instigation of new developments will, in a large measure, probably have to come from American sources, the Dominion Government has adopted an exceedingly wise policy in spending every reasonable effort and expense in having Canada's unusually favorable water power and industrial opportunities made known in the best possible manner ,at the Panama Pacific Exposition.

Less Than Two Million Developed

The latest statistical statement respecting Canadian water powers by the Dominion Water Power Branch is of great interest. Within the provinces of the Dominion and excluding the Northwest Territories, practically all of the Yukon and the northern and eastern portions of Quebec, it is estimated that 17,764,000 horse-power are available, this amount being inclusive, in the case of Niagara Falls, Fort Frances and the St. Mary's River at Sault Ste. Marie, of only the development permitted by International treaties, and, further, does not contemplate the full possibilities of storage for the improvement of capacities. The developed powers, which are inclusive of all water powers, whether for electrical production, pulp grinders, for milling or for the great many other uses, aggregate 1,712,193 horse-power as developed by turbines. This amount is distributed over the provinces as shown in the following table:

Province	Horsepower Developed
Nova Scotia	21,412
New Brunswick	13,390
Prince Edward Island	500
Quebec	520,000
Ontario	789,466
Manitoba	56,730
Saskatchewan	45
Alberta	33,305
British Columbia	265,345
Yukon	12,000
Total	1,712,193

Cost of Electricity in the Home

Old traditions die hard. With many of us, habit is more powerful than argument. This attitude of mind of the human being has delayed innumerable scientific developments. It is responsible almost entirely for the unpreparedness of the British Nation in the situation that confronts her to-day. Habit,—another word for conservatism,—keeps us in the rut, —the valleys,—where our more wide-awake neighbors inflict punishment on us from the hill-tops.

One of the oldest traditions,—and it dies hard like the others,—is that the cost of cooking by electricity cannot be made to compete with the cost of gas. We say gas because, everything considered, gas has been of late years the most economical source of heating energy available in our homes. If, then, electricity can compete with gas in price, it may be considered as having beaten by far the strongest of its competitors and thus will stand unchallenged as the most economical means of operating our kitchens and supplying, in general, our home needs.

We believe the time has come when electricity does stand, without challenge, as the cheapest source of energy supply available in many Canadian town and city homes. Even the most sceptical must admit the force of actual figures, and in our present and future issues we propose to publish data of actual operating conditions and consumptions, until the "tradition" exists only as such.

Here is number one. It has reference to the home of Mr. Wm. B. Boyd, Toronto, to whom we are indebted for permission to use the figures. Mr. Boyd has just recently completed a splendidly equipped 10-room home in the Cedarvale district, in northwestern Toronto, just outside city limits. His intimate association with electrical interests would in itself be sufficient guarantee that no electrical detail in the wiring and lighting of his home and grounds would be omitted. The house and out-buildings are equipped with upwards of one hundred lamps. All the water for the home (six occupants) and the garden and lawn (a Skinner sprinkler system is installed in the garden) is electrically pumped, and this motor is equipped with special automatic features so that water pressure is maintained at 65 to 80 lbs. Finally, all cooking and other household work is done by electric range supplemented by the usual household appliances. Electricity is used for heating water for ordinary kitchen purposes, and, in general, for every purpose around this home except for bath and wash-day requirements.

What Does It Cost?

What does it cost? Here are actual consumption figures taken from the account slips presented by the Toronto Electric Light Company for the past five months:—

February 4th to March 4th	160 kw.
March 4th to April 3rd	150 kw.
April 3rd to May 4th	140 kw.
May 4th to June 4th	160 kw.
June 4th to July 4th	130 kw.

Monthly average, 148 kw.

Monthly average per person, 25 kw.

Monthly average cost at present current rates, $3.80.

In Toronto gas costs 70 cents per 1,000 cu. ft.,—less, we believe, than in any other Canadian town or city where the manufactured article is used. There are, of course, many householders cooking with gas, whose bills do not run as high as $3.80, but we do not believe that many households equipped and operated as completely as that of Mr. Boyd keep their monthly bills down to this amount. We know of many bills that are much larger. Quite aside from comparisons anyway, this monthly bill is surprisingly and satisfactorily small, and is very strong proof that the householder of fair means in Toronto has no need to fear the expense which a little carelessness in his kitchen may entail. Even had the consumption been twice as great, evidently an unreasonable supposition, the bill would only have amounted to $5.80. Incidentally, it may be mentioned that this is not at all an unusual gas bill.

And Then the Difference!

And the bills, reasonable as they may be, tell you nothing of the satisfaction and safety in the use of electricity. No danger from explosion; the cause of many fatal fires removed; no evil smelling odors; no danger to life from inhaling the gas or its products, (the writer knows of two recent cases of "wash-lady" fainting, due to a combination of poor ventilation and an old gas stove); no destruction of the health-giving properties of the pure atmosphere by the using up of the oxygen; no silver or valuable paintings blackened and spoiled. Then compare the convenience, efficiency and lighting results. Last winter Mr. Boyd's motor-driven pump was covered with snow and forgotten for three months. How would gas engine operation compare with this record?

Illumination Program

The ninth annual convention of the Illuminating Engineering Society is to be held in Washington, D. C., September 20-23 inclusive. The papers, which promise to be of an unusually high standard, are to be distributed over ten sessions. One of the sessions will be devoted especially to the subject of street lighting; commercial, general, and laboratory papers will each be given three sessions. A general idea of the ground to be covered is given in the following partial list of papers:—"Tests and Experiments in Connection with the New Commonwealth Edison Company Building," "Ship Lighting," "Illuminating Efficiency as Obtained in an Experimental Room," "Photometry with Portable Instruments," "New Test Plate for Illumination Photometers," "Incandescent Lamp Testing and Photometry," "Street Lighting," "Gas Street Lighting," "Arc Lamps for Street Illumination," "New Types of Incandescent Lamps and Their Relation to the Street Lighting Problems," "Ornamental Street Lighting," "How to Attack a Lighting Problem," "How Can a Combination Gas and Electric Company Render the Best Service to Customers," "Small Incandescent Lamps and Special Illumination Problems," "Lighting of Office Buildings," "Crova's Method of Colored Light Photometry Applied to Modern Incandescent Illuminants," "Differences in Threshold and Acuity Variations," "Visual Efficiency," "Yellow Screens," "The Flame Pilot Ignition of Incandescent Gas Lamps," "Practical Illumination as Exemplified by Some Recent Installations of Incandescent Gas Lamps," "Mercury Arc Lamps for Industrial Lighting," "Relation Between Proper Illumination and Accident Prevention," "Retinal Sensibilities in Relation to Illuminating Engineering," "The Effect of Distribution of Light on Muscular Control," "Effect of Various Wave Lengths of Radiation on Eye Cataract," "Artificial Illumination of Interiors," "Lighting of State, War and Navy Buildings," "Lighting of Gymnasiums and Armories with Incandescent Lamps," "The Effect of Surrounding Gas on an Incandescent Filament," "The Parabolic Mirror," "Artificial Illumination in Practical Photography," "Photographic and Visual Illumination Efficiencies," "Production and Application of Ultra Violet Light," "A Flux Method of Obtaining Average Illumination."

Information regarding the convention may be had upon application to the general office of the Society, 29 West 39th Street, New York, N. Y.

A by-law was recently passed in Penticton, B. C., to expend $6,000 on electric light extensions. F. L. McKeever, M.I.E.E., is electrical superintendent.

Western Men Express Confidence in the West

Selkirk, Man., July 9, 1915.

The Editor,
Electrical News:

Replying to yours of the 28th ult. I beg to say that, in spite of the alleged "hard times" we are still progressing here in the electrical business.

Since war was declared we have increased our consumers by 12 per cent., and are still on the increase. Our kw. hour consumption for the same months during the war show an increase over the same months of the preceding year. Of course it is necessary to make greater effort to get business when the country is not quite so prosperous, but by offering the people a product at a price in harmony with the business conditions, one can get an equal amount of new business.

This is shown by our recent campaign to secure more domestic users, also to get the financial support for an ornamental street lighting system.

In the former case we offered the public a proposition to wire their houses, collecting the sum of one-quarter of the total cost in advance, and five cents on each drop light per month until the balance is paid. Although we already had connected 70 per cent. of the total number of houses in the town, we added another 37 houses in two months under this scheme.

In the latter case we secured the signature of four-fifths of the property owners of the business section of the town to an agreement to pay 50 cents per front foot tax for the erection of reinforced concrete ornamental lighting standards.

Therefore I do not yet see proof of the many complaints of "hard times" in the West. The public have responded in every way to our offers. They have paid their bills, used more energy, and accepted new propositions provided these were in harmony with the general conditions. It simply means that we must be a little more energetic in "pushing" for business, make the proposition a little more alluring, and if possible make payments extend over a longer period. This should easily be done, as there seems to be as much money as ever in Western Canada, although some short-sighted people persist in keeping it "stored away."

Yours truly,
R. Maurice,
Man. and Supt. Electric Dept.

Saskatoon, Sask.

The Editor,
Electrical News:

I might say that, as you surmise, we have not lost faith in the West; and while we are in the position at the present time that no headway is at all possible, with the exception of the usual additions to our line and connections, our business has kept up remarkably well, especially when we take into consideration the fact that we have lost so many men by enlistment and general depression. Yet the feeling here is that things are easing up, and we expect to be running at our 1913 gait in the latter part of this year if the crops come out as expected at present.

At the present time we have contracts in hand for the enlargement of the power house by the addition of two 750 h.p. Babcock & Wilcox boilers, one new turbine feed pump, one motor-generator exciter, and one LaCour motor-convertor, 600 k.w. for the street railway; also we have actually in town one complete new electrically operated switchboard, which is only awaiting construction of the addition to the building to be installed. This work is necessarily held up at the present time owing to the fact that the underwriters have been unable to come through with the money for the bonds issued; but just as soon as this is forthcoming the additions will be proceeded with, so that you see far from being downhearted or down and out, we at least are preparing for a big increase in business which we are certain will be on top of us almost before we can have our additions made.

Yours truly,
E. Hanson,
City Electrical Engineer.

Lethbridge, Alta., Canada.

The Editor,
Electrical News:

Undoubtedly the electrical business in Lethbridge has suffered from the financial and industrial depression that has been prevalent since early in 1913.

For some years back, on account of the rapid growth of towns and cities, the electrical business was in rather a frenzied condition trying to supply light and power to the houses and industries; and as a consequence extensions were made hurriedly and often without the proper amount of consideration, because public utility men were very often overworked and unable to cope with the demand for the utility.

Now we have a breathing spell and are able to take stock. We are now busy cutting out the frills and putting everything on a good sound business basis, and preparing for the large increase in the electrical business which we are confident will come. Although business has been bad for some months back, not one in the electrical business in Lethbridge has gone to the wall, and all are confidently preparing for the better, sounder, less frenzied business which is even now in sight.

Yours truly,
Arthur Reid,
Commissioner Public Utilities.

Moose Jaw, Sask.

The Editor,
Electrical News:

"I am somewhat at a loss for anything to say regarding conditions during the past few months as it has really been very quiet except that the output of the electrical plant has increased slightly over the same months of last year, due to increased day load from power and heating business.

The total horsepower of motors connected to the system has recently increased by 450 horsepower.

The completion of the new power plant which was held up in 1913, has been proceeded with since the first of this year, and is now practically finished. The plant now consists of:

1—500 Canadian General Electric turbo-generator.

1—1000 Canadian General Electric turbo-generator.

1—1500 Willans & Robinson-Siemens turbo-generator.

8—B. & W. water tube boilers with superheaters and chain grate stokers.

2—B. F. Sturtevant Co. fuel economizers and induced draft fans.

2—6000 gallons Wier boiler feed pumps.

1—12 panel Canadian General Electric main switchboard.

5—50 light Canadian General Electric 6.6 amp. mercury arc rectifiers and constant current transformer sets.

1—20 tons per hour gravity Bucker coal and ash conveyor.

We are at present in the market for eight, 100 pound dump, automatic coal scales, a Lea recorder, a 15 kw. exciter set, and other small apparatus.

During the four months ending April 30th, 1915, the total operating charges of this department including interest and depreciation amounted to $46,880.17, while the total net revenue of the department was $53,715.51, leaving a surplus of $6,835.34, which is considerably ahead of the same period of 1914 in spite of the fact that rates were reduced considerably in the meantime.

Though the number of consumers has decreased slightly, the consumption of current has increased and at the same time the cost of production has been greatly reduced and prospects are at least as bright as they ever were.

Yours truly,
J. D. Peters,
Electrical Supt.

Rossland, B.C., July 5, 1915.

The Editor,
Electrical News:

I take it that it is not a general writeup of our different plants that you require, but simply an outline as to how the unfortunate war has affected our business generally, and with this in mind, I will give you below what I trust may be of interest:

The West Kootenay Power & Light Company's hydro-electrical developments consist of No. 1 plant, situated at Lower Bonnington Falls, having an output of 3000 kilowatts, No. 2 plant, situated at Upper Bonnington Falls, having an output of 18,000 kilowatts, and No. 3 plant, situated at Cascade City, B.C., on the Kettle River, having an output of 2500 kilowatts. The power generated from the above three plants is supplied to the mining and smelting industries at Trail, Rossland, Grand Forks, Phoenix and Greenwood. Therefore from the above you can see that the load is purely derived from the mining industry, the principal metals being produced being copper, gold, silver and lead.

The silver-lead ores are produced in the Slocan country and East Kootenay, and are treated and refined at the Consolidated Company's smelter at Trail. The Rossland ores, which are gold-copper, are also treated at the Consolidated Company's works at Trail, and the matter refined at the Tacoma smelter, Tacoma, Washington The ores mined in Phoenix by the Granby Company are copper ores, and are treated and blown into blister copper at the Granby Company's smelter, situated at Grand Forks, B.C. The B. C. Copper Company's ores, which are mined at the Mother Lode mine, three miles from Greenwood, are also copper ores, and these ores are treated at the B. C. Copper Company's smelter, situated at Greenwood, B. C.

When the unfortunate war was declared, the copper and silver-lead market was demoralized, and the copper producers were compelled to shut down for lack of market. On account of the maximum values of the Rossland ores being in gold, the Consolidated Company were able to continue operations, that is, as far as the mines of Rossland and their reduction works at Trail were concerned. They were for a short period of time compelled to curtail on the shipment of silver-lead ores. This, however, was only temporary, and it might be said that as far as the silver-lead industry is concerned and the production of ores from the Rossland camp, that the war up to date has not seriously interfered with these industries. In the case of the Granby company they were compelled to shut down on account of not wishing to store their copper, as were also the B. C. Copper Company. However, this was only temporary as the Granby Company again resumed operations in November, and the B. C. Copper Company are now resuming operations.

Therefore as far as the West Kootenay Power & Light Company are concerned our revenue producing load has not seriously been interfered with, and the earnings have been such that we have been able to meet all fixed charges as well as the continuance of the dividend on common stock, and from present prospects, when taking into consideration the prices of all metals, it is safe to say the mining and smelting industry of the southern portion of British Columbia is in a very flourishing condition, and from the present outlook we look for increased business in the way of copper refining, and the producing of spelter, both of which will take large quantities of power.

The southern portion of British Columbia has probably been more fortunate than any other section, but at the same time, when taking into consideration that the province owns its natural resources, it is safe to say that we in British Columbia will probably make a more rapid recovery than any other province, just so soon as the unfortunate war conditions are ended.

Yours very truly,
West Kootenay Power & Light Co.,
L. A. Campbell,
General Manager.

Half Million H.P. for Winnipeg

The surveys of the Dominion Water Power Branch of the water powers of the Winnipeg River in the Province of Manitoba, and of the storage possibilities in the upper waters of this river in the Province of Ontario, show that it is economically feasible to develop, at eight power sites, over 409,700 continuous 24-hour w.h.p., all within eighty miles of the city of Winnipeg, and within feasible transmission distance of all the commercial centres of the present settled portions of the Province of Manitoba. Of these eight power sites, there are three now under development, representing a total power capacity of 199,024 h.p. One site is completely developed by the Winnipeg Electric Railway Company, producing 28,000 h.p. The Municipal plant of the city of Winnipeg at Point du Bois Falls has at the present time installation capable of producing about 47,000 h.p. This plant is capable of extension to a maximum of nearly 80,000 24-hour h.p. Development at the third power site, at Great Falls, with a maximum possibility of 99,500 24-hour h.p., is now under way, though temporarily delayed. At the two completed power developments there is therefore about 75,000 h.p. produced at the present time, and which can be increased to 108,000 24-hour h.p. The six remaining sites on the Winnipeg River are under the absolute control of the Dominion Government and can furnish a further amount of 24-hour power to the maximum extent of 210,700 h.p. In addition there are several important power sites on the Winnipeg and English rivers within the Province of Ontario within easy transmission distance of the city of Winnipeg. Considering all the water power sites on these two rivers in the provinces of Manitoba and Ontario, there is within transmission radius of the city of Winnipeg, a grand total of 570,000 24-hour h.p.

Calgary, Alta.

On July 5th the Calgary Electric Railway System celebrated its sixth anniversary. According to superintendent McCauley's statement, during this period the railway has built up a solid reserve to its credit of $300,000. The rolling stock consists of 90 cars and 71 miles are in operation. The number of employees has increased from an even dozen to 275. Mr. McCauley is optimistic that the deficit shown by the first few months of the present year will not be repeated.

Lighting Vancouver's Magnificent New Viaduct*

The completion of Vancouver's new viaduct has rounded out an exceptionally fine engineering effort in which utility, strength, beauty and economy—all duly considered—have resulted in a harmonious structure which is a feature of pride to the commercial metropolis of British Columbia.

Waterfront or port possibilities of Vancouver are in part an advantage and in part a handicap, for the waters of Burrard Inlet and False Creek had before the birth of the city so encroached upon the land that only a small neck permitting four highways was left to join the east and west sections of the city. Through these few streets rushed the great streams of vehicular and car traffic. Congestion resulted, and a better means and more rapid inter-communication was sought.

The solution was found to lie in the erection of a viaduct which would not only shorten the distance to be traversed, but also permit continuous passage, an impossibility in congested areas where street intersections and the resultant cross traffic cause delays innumerable even under the effective direction of the traffic squad of police.

Construction was commenced in June, 1913, by Messrs. J. McDiarmid & Company, Limited, general contractors, of Vancouver, Calgary and Winnipeg, and completed just prior to the formal opening on Dominion Day, when this half-million dollar bridge was temporarily given the name of Georgia-Harris Viaduct.

From the viewpoint of the engineer it is a thing of beauty, not only for appearance sake, but because it symbolizes safety and strength with economy, several types of construction being used to accomplish this end. Yet the structure is harmonious in its entirety, because it embodies none of the ugliness of engineering afterthought—excrescences of unexpected additions or reinforcements. Incidentally it is a credit to the engineers who had charge of the planning and construction: F. L. Fellowes, city engineer; C. A. P. Turner, consulting engineer; A. P. Hueckel, supervising engineer; Jas. P. Kennedy, engineer, and Mr. Thos. Borgford, general superintendent at Vancouver, for the contractors.

The viaduct, which runs east from Beatty Street to Main Street, is 2,860 ft. in length, with a maximum grade of 3.11 per cent. at the east end, and 66 ft. wide. Eighteen thousand cubic yards of concrete have entered into its construction, and nineteen thousand tons of steel. The roadway, which is double-tracked with 80-lb. steel rails on steel ties bedded in concrete, and is 53 ft. in width, required 1,500 square yards of paving, bitulithic and granitoid being used. The trackage is the property of the city and will be rented to the B. C. Electric Railway Company, Limited, but is not at present in operation, as the transportation company have been unable to complete arrangements for its use.

Sidewalks are 6 feet wide, and they and the gutters are of cement.

The spans vary from 25 to 280 feet, according to the dictates of trackage, lanes and other existing systems which it was desirable not to disturb, for this viaduct crosses streets, lanes, the C. P. R. and B. C. E. Railway yards, the G. N. R. depot and yards, and False Creek.

Short spans are of slab or mushroom construction; girder and continuous Warren truss construction are also used, according to the dictates of economy and needed strength. One of the spans required girders of reinforced concrete 83 ft. 6 in. in length, which is believed to be a record for bridge girder span constructions.

One-half million dollars was the actual construction cost and is exclusive of any amounts which have had to be paid for the removal of buildings and for other indemnity to property owners.

The whole structure is finished off with an ornamental rail, of which the lighting standards form a prominent and classic feature.

Electrical Installation and Lighting

Both the rail and ornamental lighting standards, details of which are shown on the accompanying illustrations, are

* By Mr. H. E. Grant.

Day view of lighting system recently installed on Georgia-Harris Viaduct, Vancouver.

really an artificial stone. They were moulded in sand right on the job and then set in place as masonry.

Trolley standards are of round steel tapered 6 in. to 4 in. and 27 ft. in length, and are placed in a larger thimble anchored to a reinforced concrete slab. A round finial is used to harmonize with the lighting standards. Mr. C. H. E. Williams, of Vancouver, was contractor for the electrical work in its entirety.

Those responsible for planning the lighting of the via-

Near view of viaduct standard.

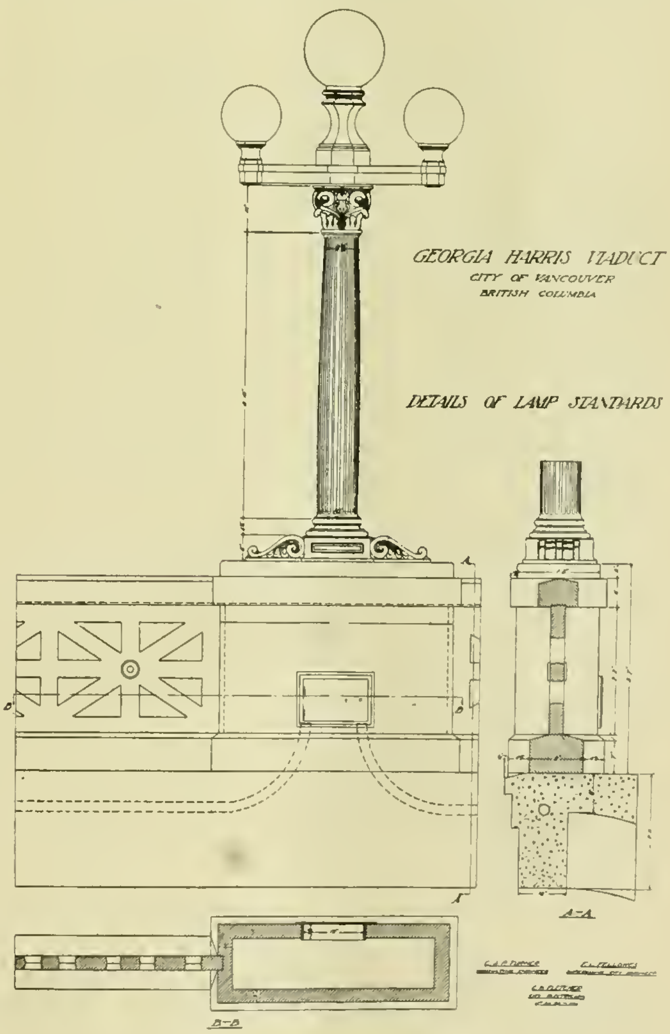
duct were apparently not seriously concerned with the correct spacing of units, the securing of uniform intensity, or the efficiency of upright versus pendant globes as regards the quantity of light flux incident upon the plane of illumination. It will be noted that the spacing is extremely irregular, the globes upright, and of heavy density. The irregular spacing and other seemingly adverse lighting conditions resulted from a desire for a balanced appearance of the complete structure. Lighting considerations were apparently secondary, but the effectiveness of the installation is beyond question. It answers all purposes and satisfactorily fills all requirements, and while the excellence of the illumination leaves nothing to be desired, it should not be forgotten that a definite economy has also been secured by Mr. C. H. Fletcher, city electrician, who has had direct supervision and control of the installation and choice of the electrical equipment. Changes were made from the installation originally decided upon, and these have resulted in greater effectiveness combined with economy both in installation and operating costs.

Descriptive articles on the White Ways of the West always feature Vancouver as one of the most prominent and progressive street lighting cities. The advertising value of good lighting has been long appreciated, as is indicated by the fact that the city now possesses 14.5 miles of ornamental street lighting and 3.4 miles of bridge lighting, or approximately eighteen miles of ornamental street lighting, composed of 886 five-light and 74 three-light standards, these latter being the first venture of this kind at English Bay bathing beach, and one of the earliest on record. It is of interest to note that the number of standards during the past two years has increased from 507 to the figures abovementioned. A multiple system of tungsten lighting is used throughout, but recently changes have been made by city electrician Fletcher on 108 standards for the purpose of effecting further economies, the system used being the same as that adopted for the new viaduct. The saving in current by this system is 22 per cent.; improved lighting results, and the cost of the change is cancelled by the economies effected within two and a half years.

In the new viaduct installation there are 54 standards, the spacing varying from 85 to 125 ft. Each consists of five upright 10.8 volt nitrogen lamps, the four lower ones enclosed in 12-in., and the centre lamp in a 16-in. dense opal Mellite globe. By means of a solid wire goose neck these lamps are suspended in a pendant position, which is most suitable for the efficient operation of this type of lamp.

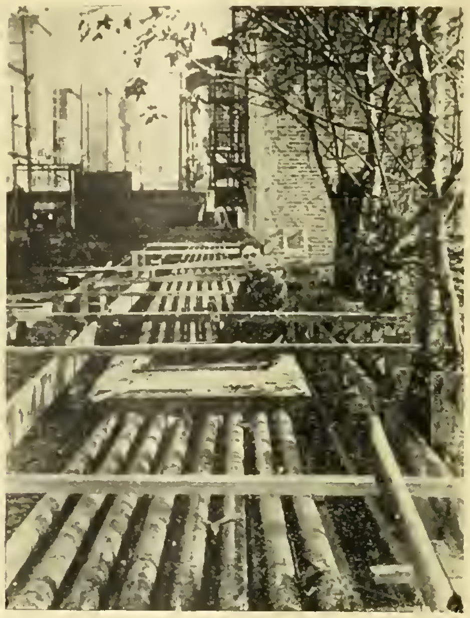
The low voltage is secured by the installation of a 350 watt C.G.E. compensating transformer in the base of each standard, this type of transformer being chosen on account of the various taps which it is possible to bring out, thereby permitting compensation for drop in the different parts of the circuit and to accommodate the various efficiencies of this lamp, so as to permit the most economical operation. A pair of No. 14 wires to run to each lamp, and each is separately fused. Each lamp and each standard are also numbered for lamp performance and maintenance record purposes.

Services, four in all, and each consisting of three No. 2 R.C.D.B. wires, are conveniently brought in at the east end and at a point near the centre of the viaduct. The wire



Showing details of standard.

feeding the standards varies in size from No. 1 to No. 8 at the most extreme points, and is run in Orangeburg fibre duct,



Fibre ducts and typical manhole.

5,700 ft. being used for this purpose. The size of the wire is changed at boxes in the base of ornamental standards. This wiring is so arranged that opposite standards at certain points are able to be tied in, thus permitting a change to series distribution should future lamp developments make this advisable.

The B. C. Electric Railway Company have arranged special primary circuits which permit control of the ornamental lighting system from their sub-stations, and the lights are turned on and off by the company in accordance with a schedule supplied by the city electrician.

As is usual in this class of lighting, half the standards are shut off at midnight, when the advertising value of what might be termed the "excess" light used for this purpose is no longer required and the value of the lighting for protection is predominant.

The operating cost of each viaduct standard, including cost of current, lamp renewals, cleaning and probable repairs, is estimated at $48 per annum, and the installation cost at approximately $150 per standard.

Eighty-five thousand feet of 3-in. Orangeburg fibre duct was also installed under sidewalks for light and power purposes, with the object of relieving down-town congestion of aerial distribution and to effect economies of distribution both as to cost and line losses. Metal sleeves were installed at bridge expansion joints in which the conduit would readily slide. Bolts have been set in the viaduct, so that the B. C. Telephone Company may also at a later date suspend main ducts from the underside of the structure and thus take advantage of yet another economy and utility which this timely and useful viaduct affords.

Decade of Development in the Prairie Provinces*

(For the purpose of this article "Prairie Provinces" includes Ontario, west of and including Port Arthur, Manitoba, Saskatchewan and Alberta).

A great deal has been written about the growth of the "Prairie Provinces"—population, building permits, bank clearings, school attendance, etc., etc., in the past decade, but as far as the writer is aware no data has been compiled making a comparison between the kw. capacity of generating apparatus installed ten years ago and at the present time. It was about the former period that the so-called "boom" became recognized as a period of amazing prosperity, and the whole of Canada began the rapid strides that have resulted in an unprecedented development that has astonished the whole world.

January 1st, 1905, found several small plants under contract, the installation of which was completed shortly after the beginning of the year, but the following, I think, is a complete list of all cities and towns in the territory under consideration in which electrical energy was available for public consumption, either as light, power, heating or for electric railways:—

Western Ontario

Kenora (Rat Portage), Fort William and Port Arthur.

Manitoba

Brandon, Minnedosa, Morden, Neepawa, Portage la Prairie, Selkirk and Winnipeg.

Saskatchewan

Princ Albert, Moose Jaw and Regina.

Alberta

Calgary, Coleman, Edmonton, Frank, Lethbridge, Macleod, Red Deer, Strathcona and Wetaskiwin.

The entire rated kilowatt capacity of generators installed in the twenty-two cities and towns above named at this time did not exceed 12,500 kw., and electric railway systems were in operation at only two points, viz., between Fort William and Port Arthur and in the city of Winnipeg.

January 1st, 1915, the rated kilowatt capacity of generators installed in the above named cities and towns (there have been practically no additions since that date) was approximately 152,000 kilowatts. In the "Prairie Provinces" there are at present just over 100 corporations, municipal and private, fully equipped for the purpose of supplying electric energy for public consumption, the combined rated capacity of which is approximately 173,555 kilowatts. Ten cities in this territory now have electric energy in operation.

The following table shows the increase by provinces:—

	1905	1915
Western Ontario	11,280 kw.	22,410 kw.
Manitoba	8,150 kw.	75,870 kw.
Saskatchewan	375 kw.	19,325 kw.
Alberta	2,470 kw.	55,950 kw.
	12,275 kw.	173,555 kw.

It is of interest to note that while more than ninety per cent. of the above properties are municipally owned, with the exception of the city of Winnipeg development alt of the large power plants have been developed and financed by private corporations. The source of power for developing the energy required in these Prairie Provinces shows some unexpected conditions; of the entire 173,555 kilowatts developed to date approximately 100,000 kilowatts are water power installations, about 65,000 kilowatts steam station and the remainder using as a source of energy gas producers and Diesel type oil engines in the ratio of about 2 to 1 in favor of the former. From the above it will be seen that although we are the "Prairie Provinces," water falls are

* By Mr. W. E. Skinner, Consulting Engineer, Winnipeg.

our chief source of power. Within the boundaries of Manitoba alone there is to be found water power to the extent of 3,000,000 h.p., and it is certain that large amounts of water power will be available in the other provinces in consideration.

Not alone in the matter of installation of generators have these Prairie Provinces made rapid strides. In the year 1905 and those immediately succeeding a rate of from fifteen to eighteen cents per kilowatt hour was the rule, while in some cases as much as twenty-five cents was charged. To-day even the smallest town in which a plant has been installed a rate of more than twelve cents is thought exorbitant, and in the larger cities a rate of six cents for light and from four to two cents for power; while in the city of Winnipeg a rate of three cents for light and down to one cent or even less on some large contracts is charged.

There are many other phases of this development that could well be discussed in this article but the above will suffice to show the giant strides that have been made in the past decade. With the vast resources at hand and the immigration that will undoubtedly flow into this country at the close of the great war that is now in progress, it is practically impossible to predict what the next decade will bring forth. It is reasonable to expect, however, that many new uses for electrical energy will be found, and that the development of the future will not be less than in the past.

Western Canada Power Company Doing Its Part*

Nothing that has happened during the past two years in Vancouver can permanently retard its growth. It is going through the cycle that has been passed by all the large cities on the Pacific Coast. It has had its boom and is now in the period of reaction, which the war has not wholly caused—only made more marked. The rise from the reaction period will follow as surely as the other cities have risen from their reaction period, but it can hardly commence until the war is over. When the rise does commence it will doubtless be slow at first, but the growth will be steady and cumulative from year to year. The improvement will probably be led either by the mining industry or the lumber industry, or by the grain trade, or by all three together. Improvements in railway and steamship freight business and the smaller industries will follow.

After the war is over, the position of Vancouver for overseas trade will be much better than heretofore, because of the new markets that the war has laid open and the Panama Canal has made accessible.

In the meantime the fishing industry has not been affected by the reaction, but has grown and will continue to grow. The total value of the fisheries in the province for one year is about $9,000,000. Dependent upon the fisheries are cold storage plants, box factories, canning factories, and numerous boat building shops and small marine repair works; these will continue to develop steadily.

The lumber industry is seriously hampered by the impossibility of securing ships for transporting the lumber to European ports; but for this, the Vancouver mills would be far more active than they are now, and would be enjoying much higher prices.

The shingle business, however, is very active, and there is a large demand for cedar logs. As an example of this it may be stated that the Western Canada Power Company is hauling, every month, over its five miles of railway, over three million feet of logs out on the margin of Stave Lake, and about sixty cars of shingles from a mill located on the Stave River.

The mining industry is very active. The Granby Company is handling more copper ore than it has ever handled before, and is increasing the capacity of its smelter at Anyox, North of Prince Rupert; while the Britannia Mine, which is not more than 50 miles from Vancouver, is making large increases in its plant.

The completion of the new railways in British Columbia is having the effect of opening up a mining belt heretofore inaccessible, and it is pretty safe to predict that the next ten years will see very large mining developments in British Columbia, including smelters and refineries, which are likely to be placed in the neighborhood of Vancouver.

Perhaps the most important step in Vancouver's future has just been taken, in the commencement of the construction of the Dominion Grain Elevator on Burrard Inlet. This will be ready for business in the spring of next year, and from that time on, grain will commence to go out through the port of Vancouver in quantities that will gradually increase from year to year, until Vancouver, with its port open every day of the year, will eventually become one of the large grain shipping ports. The advent of the grain elevator will help the cost of living in Vancouver in many ways; for instance, the cost of cattle feed will be reduced and this will help the establishment of dairy farming on a large scale in the district surrounding Vancouver, thus enabling farmers to supply what is now imported from foreign countries.

The electro-chemical industry is one that would have been initiated in the neighborhood of Vancouver but for the war, and as soon as any improvement takes place it is most probable that certain industries of this nature will be established. For the smaller electro-chemical works and steel furnaces, the Western Canada Power Company has power already available. For the larger chemical works, such as nitric acid plants, there are numerous water powers on the coast that can be developed as economically as anything in Norway.

The Western Canada Power Company's business has naturally suffered in the general reaction, but like all other water power plants, it can be operated at a low cost, and has a distribution system covering approximately the whole district surrounding Vancouver, so that new industries can be supplied with power without any expensive extensions. It is therefore ready to meet and help the first signs of improvement.

Those who have lived for any length of time in the West, and have seen the wonderful development of the past twenty years, have faith to keep them in a new country, full of resources like British Columbia, in preference to any other part of the world, even if the whole world were financially exhausted by the war.

* By Mr. R. F. Hayward, General Manager.

An order has been issued by the Dominion Railway Board requiring the C. P. R. and G. N. W. telegraph, and the Bell telephone companies to remove their poles and wires from certain streets of the city of Hamilton.

District superintendent of telephones Warren is leaving Moose Jaw to take a similar position for the government in Saskatoon. He is succeeded by Mr. C. A. Moore, of Swift Current.

Electric Cooking in Western Provinces*

One of the outstanding features in the development of Winnipeg and Western Canada in the past few years has been the increase in the sale of electric ranges and electric current for domestic use. This increase has been so great that at the present time it is believed Winnipeg has more electric ranges in daily use than any other city of anything like the same size in the world.

There are in use approximately 3,000 electric stoves of all sizes, ranging from a single burner hot plate to a six-burner, with oven, range. This number includes eight apartment blocks, ranging in size from eight to thirty-eight suites, which are equipped entirely with electric ranges.

What have been the causes of this remarkabe use of electric current for cooking purposes? In this article, the writer has endeavored to give a few of the principal reasons.

Without question, the principal cause has been cheap electric current. In this respect Winnipeg is most fortunate, as the rates given by the Civic Power department and by the Winnipeg Electric Railway Company, are to be equalled in point of cheapness, in few Canadian cities.

To illustrate this cheapness of current, the rate given by the Civic Power department will be taken as an example. This rate is 1c per kw.h with a minimum charge of 75c per kw. installed, with a discount of 10 per cent., subject to the condition mentioned below. For example: supposing a householder installs a range with a capacity of 4.5 kw. (a popular size, being a stove with three burners and oven), his minimum monthly charge is 75 x 4.5, or approximately $3.40 per month. This amount allows for the use of current up to 340 kw.h. Any current over this quantity is charged at the rate of 1c per kw.h., with a discount of 10 per cent. This discount applies only to the amount over and above the minimum; the average family rarely, if ever, carries the consumption beyond the minimum figure.

Value of Publicity

Intelligent and persistent advertising has been another means of promoting the use of electric ranges. It is a well known fact that the public is usually "scared" of anything new, or which does not come to them well tried and proven. Electric cooking was too radical a departure from long established methods to be taken up immediately, consequently it was necessary to break down the popular prejudice. This has been done by advertising, which has been carried on by the manufacturers and the electrical dealer and contractor, and which has taken the form of demonstrations and campaigns conducted through the newspapers and through the mails. The demonstrations, which probably have been the most successful form of publicity, were held on several occasions in the Industrial Bureau Building, and on one or two occasions exhibits were made at the Winnipeg Annual Industrial Exposition. They have always been actual installations of electric ranges, in charge of competent sales-ladies, who have also been first-class cooks. Actual cooking and baking was done, giving to the public in a few moments' time a better conception of the possibilities of electric cooking than could be given in hours of talk. These demonstrations have always been largely attended and proved, from the electrical dealers' standpoint, a valuable means of education.

The Dealer and Contractor

The electrical dealer and contractor has also assisted very materially in advertising electric ranges. The extra wiring required (as the Winnipeg bylaws require a separate service for each range installation), is an inducement to an enterprising contractor to get an order for an electric stove, and in many cases a little extra effort in this direction has resulted in the sale of a range. The range business is a profitable one for the contractor, as it gives him the extra work, and also nets him a reasonable profit on the sale of the stove itself.

Probably second only to cheapness of power as a means of promoting the electric range, is its superiority over every other means of cooking. By its use the housewife benefits in the following manner: First, there is no waste heat, as the heat is applied exactly where it is wanted, and in the right degree. Second, absolute cleanliness is possible at all times. Third, labor is reduced to a minimum because an electric stove is always ready. Fourth, with no flame, there is perfect safety. Fifth, the character of the stove permits of more time for social duties.

Taking all these facts together, it is evident that an electric stove is safer, more sanitary, socially more desirable, and from a labor saving standpoint is more acceptable than a coal or gas range, as there is no smell, no dirt, no ashes or coal to carry, and no wood to split.

Cooking is Now a Science

From a culinary standpoint, the electric range is also superior to the old style range. It has made cooking an exact science from which chance has been practically eliminated. Just as each ingredient portion of each dish is known to the modern cook, so is known the correct portion of heat to apply. With the electric range the heat can be perfectly adjusted, so that when the pot, saucepan or kettle is placed over the burner, the operator can apply exactly the amount of heat for perfect results. Consequently, the electric range has solved the greatest and most troublesome problem in cooking—that of applying sure, steady, uniform and known heat each time a certain dish is cooked.

Summing up the foregoing, it is evident that cheap current, advertising, and the merits of electric cooking, have been largely responsible for the growth of the electric range business in the West. That the electric range is here to stay, there can be no doubt. What Winnipeg has done, other cities and towns can do and are doing. Fort William has between four and five hundred ranges installed, with one apartment block completely equipped. Saskatoon has two hundred ranges, with four apartment blocks. Edmonton has one hundred ranges, with one apartment block and one baker's oven with a capacity of sixty loaves. Calgary and Selkirk have each fifty ranges. There are also numerous installations in Estevan, Swift Current, Moose Jaw, Vancouver and Victoria. There are also various public institutions, such as hospitals, domestic science schools, etc. throughout Western Canada, which are equipped entirely with electric ranges. Quite recently a baking oven of large capacity was placed in service by one of our Western Universities.

The Editor is in touch with an electrical supply house requiring the services of an A1 man as salesman for a special line of electric lighting equipment. This is a position, we understand, where a young man, if he makes good, can also practically name his own salary. We should be glad to put any of our readers, who feel that they can handle this position, in connection with the firm manager.

* By Mr. R. H. Mainer.

The Electrical Activities of Vancouver Island

The record of the British Columbia Electric Railway Company, Limited, in all its branches on Vancouver Island during the past few years is very interesting, being full of development, enthusiasm and co-operation, and a little insight into what has been accomplished is furnished herewith:

	Year 1910	Year 1915
Horse power developed	4,000	33,000
Light and power customers	5,000	13,500
Industrial motor load	1,900 H.P.	16,000 H.P.
Passenger and freight cars in operation	40	119
Miles of track	25	66

The original electrical energy developed by the company consisted of 2,000 kw., furnished from the hydro-electric plant at Goldstream, and 1,000 kw. from a steam plant in Victoria. The rapidly increasing street railway, lighting and power loads, however, and the company's desire to meet all demands for the future in respect to these services, necessitated the erection of the Jordan River plant, the capacity of which is now 16,000 kw. The first unit of 4,000 kw. of this plant was put in operation in the fall of 1911, and followed a little later by another unit of similar size, and in October, 1914, the third unit of 8,000 kw. was put into commission.

The company also erected at Brentwood a steam auxiliary plant of two 2,000 kw. turbo-generator sets and six B&W boilers, having a heating surface of 4,780 square feet each. A motor-generator set of 1,500 kv.a. capacity is installed to satisfy the d.c. power demand of the Saanich railway. This steam plant is also used as a high tension distributing point. The 60,000 volt lines of the company radiate from this building to two cement plants in the vicinity, and to the city of Victoria, 12 miles away; also, an 11,000 volt transmission line is sent out from this building to supply power and light to the Saanich Peninsula.

While a very large amount of work in connection with the street railway department in the city of Victoria and neighboring municipalities of Oak Bay and Esquimalt has been carried out in double tracking, making improvements to buildings and rolling stock, the chief item of importance is perhaps the interurban extension from Victoria through the Saanich peninsula. This branch of the company's system is 23 miles in length and was opened for traffic on June 18th, 1913. A steadily increasing business is being built up on this division. Almost the entire line is through high-class farm lands, which supply large quantities of produce that is shipped into Victoria to the public market.

For the convenience of its patrons and picnic parties generally, the company operates a small hotel at the Deep Bay terminus of the line.

Near the city of Victoria the company own and operate an amusement park called "Gorge Park." Many features are to be found in this beautiful spot—boating, scenic railway, shoot-the-shutes, dancing and bathing pavilions, Japanese tea gardens, etc., here accommodate many thousands during the summer months and tend to help the company's city traffic.

Mr. A. T. Goward.

The type of passenger car operated on the Saanich division is the standard interurban semi-steel coach built by the St. Louis Car Company, equipped with G. E. 204 motors and multiple unit control. A regular freight service is also

Deep-Bav Hotel, showing station and waiting car—Vancouver Island.

Typical scene in Gorge Park.

maintained by the company, two 35-ton locomotives being in use.

The company's lighting and power business, as previously indicated, has shown a remarkable growth during the past five years. Many improvements have been made in street and store lighting. Rural districts have had series tungsten street lighting systems installed; and throughout the Saanich peninsula, following the advent of the railway, residence lighting and power business has been energetically pushed, so that to-day practically all homes within a reasonable distance from the transmission lines are now served with light, and many have electric pumping installations. In addition, also, a considerable general power business has been obtained. In the Saanich division two of the company's largest power consumers are to be found, the Associated Cement Company of Canada, Limited, and the Vancouver Portland Cement Company, with 4,185 and 3,532 h.p. respectively, connected.

The commercial department has carried out many campaigns recently in co-operation with the various electrical dealers, with whom the closest and best relations exist, some of the more important campaigns being surburban house wiring, fixtures, irons, ranges, toasters, etc. These items and others have been extensively pushed jointly, and the company has extended liberal use of its mailing and advertising department to back up these campaigns, the results from which have been very gratifying. Electric cooking is now well established in Victoria, some 300 installations being in use. Included in this number are two apartment houses equipped with cookers, one having 30 and another 12 ranges connected. The electric truck and pleasure vehicle have not been overlooked, and this interesting end of the business is steadily improving, the number of electric cars in use in the city at the present time being 60.

From the above it will be seen that a very creditable all-round business is being worked up, and the outlook for the Island branch of the company's operations is very encouraging, and with the completion of some important works now in course of development will prove of material value in order to draw travel, etc. The principal works under construction in the vicinity of Victoria are the rifle range, the experimental farm at Bazan Bay, and the new observatory at Little Saanich Mountain, all these being Dominion government undertakings, and to all of which central station power will be available, and within easy walking distance of the company's interurban line.

Mr. A. T. Goward is the Victoria manager of the B. C. Electric Railway Company, Limited.

Moose Jaw Electric Department More Than Holding Its Own

While a serious depression, due to the outbreak of the European War following upon a period of great financial stringency, has existed throughout the year in practically all lines of business the output of this department has been maintained almost equal to that of the previous year, notwithstanding a considerable decrease in the number of consumers connected to the system. The total output of the plant for the year was 3,739,990 kw. hours as against 3,762,963 kw. hours for the preceding year, the decrease being only 22,973 kw. hours or .61 per cent.

The average load on the plant during the year was 426.9 kilowatts and the peak load was 1425 kilowatts, thereby making the load factor (or proportion of average load to peak load) 30 per cent.

The peak loads, average loads and load factors for the last four years were as follows:—

Year	Peak Load	Average Load	Load Factor
1911	920 kw.	128 kw.	13.9 per cent.
1912	1175 kw.	258 kw.	21.9 per cent.
1913	1475 kw.	430 kw.	29. per cent.
1914	1425 kw.	427 kw.	30. per cent.

The steady and rapid increase in the yearly load factor during these four years indicates very clearly the effect of making rates that will tend to increase the output of the plant without increasing the peak load on the plant in the same proportion. Prior to the year 1911 no special rates were given for heating and cooking purposes and the power rates were much too high to be attractive to power users. The greatest reduction in cost per unit output effected by this increase in load factor is naturally in fixed charges, such as interest, depreciation, etc., but under ordinary conditions a substantial saving is also effected in wages and fuel on account of the increased average load. As an illustration of this, the fixed charges per kw. hour output in 1911 amounted to 2.086 cents, while in 1914 they amounted to only 1.05 cents per kw. hour. During the same period the labor cost has been reduced from 1.168 to .841 cents per kw. hour.

The number of consumers connected has decreased during the year from 3,450 to 3,126 which is a decrease of 324 or 9.4 per cent. During the past seven years the current used per consumer connected per year has increased from 771.3 kw. hours to 969.7 kw. hours and at the same time tungsten lamps have been introduced and almost universally adopted. These lamps reduce the current used (per candle power of light) by about two-thirds. This rather remarkable increase further illustrates the benefit of giving special rates for certain classes of business that could not otherwise be procured.

In the month of July a reduction of rates went into effect the most important points of which were:—

1. The fixed charge to power consumers which formerly varied from $1.25 to $1.00 per horse power per month, according to the size of the installation served, was reduced to $1.00

* From report by Mr. J. D. Peters, Electrical Superintendent.

for any size of installation, the meter charges remaining as before.

2. The lighting rate was reduced from 8 cents per kw. hour to 7 cents per kw. hour with the same prompt payment discount as before.

3. The rate formerly given of 5 cents per kw. hour for heating and cooking on a separate meter and that of 5½ cents per kw. hour for the same service with light included, were cancelled, and a two-rate scheme adopted by which the current for any purpose can be obtained at 3 cents per kw. hour except during the hours between 4.30 p.m. and 11 p.m from September 1st to March 31st, and 7 p.m. and 11 p.m. from April 1st to August 31st. For all current used during these hours 7 cents per kw. is charged. These bills are also subject to prompt payment discount as before.

4. The charge for street lighting was changed from a flat rate of $100 per lamp per year to the actual cost of maintenance plus two cents per kw. hour for the current used. This will be found to be equivalent to a reduction of about twenty per cent. in the charge against the city for this service. For the tungsten lighting the new chage is 2½ cents per kw. hour for current supplied at the centre of distribution.

This reduction of rates reduced the revenue of the department and the cost to the citizens of Moose Jaw by about $30,000 per year and has placed Moose Jaw in the van of Saskatchewan cities insofar as low cost of electric service is concerned. In this connection it is worthy of note that two other Saskatchewan cities have outputs about three times as large as that of this department and this is a great advantage in their favor. By comparison of cost in Western cities the standing of Moose Jaw in this respect will be readily seen. This comparison is made by taking actual bills in Moose Jaw and figuring them out at the rates in other places.

The new schedule of rates is proving quite satisfactory and economical to consumers using electricity for cooking and other domestic uses, and several consumers who do all their cooking by electricity have made the statement that the cost is less than cooking with coal, not only in summer but also during the winter months. This rate also stimulates the use of current for lighting dark stores and basements during the day. The effect of much business on the day load and summer load on the plant was very noticeable during last year. By comparing the monthly outputs with those of the previous year it will be found that during the month of May, June, July, August and September, the output was considerably higher than during the same months of 1913, while during all the other months of the year except January, it was considerably lower. Had it not been for this increase during the summer months there would have been a serions decrease in the year's output as compared with the previous year, which would no doubt have converted the surplus shown for the year into a deficit.

Some difficulty has been experienced in obtaining two-rate meters for this class of service. None of these are manufactured in America and the British manufacturers were so upset by the outbreak of the war that they could not fill their orders. On this account the first order given for two-rate meters was not entirely filled in seven months. The cost of the meters is also a heavy item for this department and it will probably be found after using a number of them for a time, that an average rate may be adopted to advantage and thus eliminate the expenditure on two-rate meters. This scheme is the ideal one for selling current, as by it the current which actually costs more to produce is sold at a higher price.

Revelstoke Adding to Generating Equipment

Thanks to the foresight and aggressiveness of the citizens placed in charge of municipal affairs, and the backing given them by the leading taxpayers, the city of Revelstoke, with its municipally-owned electric power plant in charge of C. North, electrical superintendent, is able to quote rates for power, heat and light which compare favorably with the lowest obtaining anywhere in Canada.

The power plant is located on the Illicillewaet River, near the C. P. R. main line, one and one-half miles east of Revelstoke. The present installation consists of one spiral case horizontal turbine of 900 h.p. Jenckes manufacture, direct connected to one 450 kw. Westinghouse 3-phase generator. The turbine is operated at a normal head of 73 feet, and the water is conveyed to it by means of a 6-ft. wood stave pipe. For emergency use, also to assist at peak load, if necessary, a 300 h.p. Premier gas engine and producer is installed, which is connected with a 250 kw. 3-phase Westinghouse generator.

The new unit consists of one spiral case double discharge horizontal turbine of 1,400 h.p., Escher Wyss manufacture, direct connected to one 750 kw. Westinghouse 3-phase generator. Water will be conveyed to this turbine by a second stave pipe, six feet diameter. It is expected that this unit will be in operation some time during September next.

The present number of consumers connected is approximately 800. Rates are given to power consumers from ½ cent per kw.; for heating, at 3 cents per kw.; and for lighting, from 7¼ cents per kw. In addition, houses using electricity are permitted the use of a 16 c.p. lamp or equivalent on porches or verandahs free of charge.

The streets are lighted by 50-four amp. G. E. magnetite arc lamps and 200-four amp. nitrogen-filled lamps from 100 to 500 c.p.

Financially the plant is a good investment for the city, as it pays all running expenses, interest and sinking fund on the investment, and also supplies street lighting, light for city hall, three schools, two fire halls and police station. The heating of the city hall and the largest fire hall is also done by electricity.

Lineman's Life Saved

While working on the switching tower of the Toronto Power Company, at the Twenty-mile Creek, Alfred Farrell, received a shock on the 60,000 volt transmission line causing him to fall twenty feet in an unconscious condition. Wm. Smith, the foreman, and another employee, ran to his assistance and finding him apparently dead, started resuscitation and kept it up until respiration was restored, after which time the doctor arrived. The injured man was then removed to Silverdale, and taken by train to Welland Hospital, where his burns and a fractured knee are being attended to. He will be at work again before long.

The recovery of Alfred Farrell is very remarkable, as a shock on a 60,000 volt line is usually considered fatal. This case emphasizes the tremendous importance of immediate and skilled resuscitation to persons apparently dead from electric shock, and points to the reasonableness of the compulsory training of employees in this science. An active campaign is being carried on by the Canadian Electrical Association, an organization of Canadian privately owned electrical companies, and it is hoped that many lives may be saved as a result.

Edmonton has finest Department Store

Edmonton, Alberta, claims some of the finest isolated plants in Western Canada, and one of them is the installation which was completed in the latter part of 1914 for the Hudson's Bay Co. magnificent store. The equipment is complete in every detail, but the building is dependent also on the city power plant in case of emergency, for its electrical lighting.

The retail store is clay brick structure, having a frontage on Jasper Avenue of 120 feet and 160 feet on Third Street; is four story on the main part with an additional two-story on the rear part of the building, these being used as general offices for the retail store.

The present power plant consists of two horizontal return tubular boilers 18 feet by 72 inches, burning local lignite coal hand fired; two 150 h.p. Westinghouse turbines direct connected to two 100 kw. direct-current compound wound three-wire generators; a 14-ton refrigerating plant, ventilating fans, pumps, air compressor, etc.

The turbines are rated at 150 h.p., but are capable of carrying a 20 per cent. overload for a period of four hours. The generators are also capable of carrying an overload of 25 per cent. for two hours, with a maximum rise in temperature of 60 degree centigrade above the surrounding air; these machines are three-wire and connected to the switchboard by means of underground cable in conduit. The compensating coils are located behind the main switchboard, and are connected in the same manner. The voltage of the generators is 220-110 volts; the 220 voltage is used on motors, and the 110 voltage is used on lighting circuits.

The main switchboard is two inch Blue Vermont marble, surmounted by a marble cornice; is 15 feet long and 6 feet high, and stands five feet from the wall; it is made up of five panels, three of these bearing the light and power switches, and the remaining two are generator panels. The light switches are single throw triple pole, fused with enclosed cartridge fuses mounted on the face of the board, and the power switches are single throw double pole, fused in the same manner. Name plates above all the switches indicate the portion of the building or piece of apparatus controlled by them. Switches were used on power circuit instead of circuit breakers as in the case of a short circuit on the power line, the fuse will blow out before the main line circuit breakers open, thus preventing a cessation of service. It is a familiar happening that the action of the main circuit breakers also open. It is obvious that the continuity of service is imperative in the lighting of a departmental store, and must be given first consideration in the design of the electrical system and apparatus.

The totalizing panel carries ammeters which indicate the current output of the generators, two Columbia integrating wattmeters, one to record the output for lighting service, and the other for power ground director lamps, two voltmeters, switches and ammeter switch. On each generator panel are mounted two ammeters for reading the current on the two legs of the system, a double pole interlocking circuit breaker, one single pole and two double pole switches, and a field rheostat and voltmeter plug. At the end of the switchboard is a bracket carrying two voltmeters, and by means of these meters and the arrangement of the voltmeter plug wiring, the voltage of the busbars and the incoming machine may be read simultaneously when paralleling generators.

There is only one set of busbars being used for the light and power service. These busbars are tapped to the various switches by copper straps, and from these copper rods extend up through a slab to the outgoing feeders by means of heavy lugs. Directly over this is a junction box in which the cables distribute to the several conduits.

The power feeders supply current to the motors driving the ammonia compressors, elevators, ventilating fans, pumps, and the motor-generator set used on the signalling system. There is a total of 22 motors, having a total capacity of 125 kw. All the ventilating fans, motors, and ammonia compressor are provided with speed controllers giving reduction below or increase above normal by armature and field control respectively. Several of the pumps are controlled automatically by float switches located in the tanks or pump pits, others by pressure regulators, which start the pumps when the pressure drops to a certain predetermined value, and stop them when the pressure is raised a certain amount.

The lighting feeders distribute to a panel on each floor, and the lights are controlled by means of switches controlling two lights each in various parts of the building wherever convenient.

Lighting fixtures on the upper floor are finished in bronze and dull brass, and of a type best suited for their location and kind of illumination desired. In the sale space semi-indirect fixtures are used, while direct lighting is used in the stairs, halls and workrooms. Alba shades of pleasing design are used throughout the building. The first floors are lighted by means of 250 watt nitrogen lamps. These are controlled from push switches located on pillars close to the lamp; two lamps are controlled by each switch.

The show windows and marquise lights are controlled by a special panel located on the first floor, each having one set of busbars. In the basement there is one panel controlling all the lights, and each individual lamp is controlled by a push switch located near the entrance to the room.

The show cases are lighted from circuits taken directly from the light panels and terminating in floor boxes or base plugs; each case has a separate push button switch mounted in a recess in its base thus giving individual control of case lights. There is a total of 233 60 watt lamps used in the show cases, a total of 45 semi-direct fixtures throughout the store, and the marquise over the Third Street entrance has 57-25 watt lamps.

Employees' Signal System

In a conspicuous place on each of the sales floors there is a light bracket having four different colored lamps, and a gong having a different chime from that of the telephones is located nearby. This is used as an employees' signal system, and is operated by a control board at the telephone exchange located in the building. By pushing a button the gong rings intermittently on all floors, and four push buttons, having pilot lamps of same color as those in the brackets control the lamps of respective colors on all floors. Four important employees, who might be needed or wanted at various points in the store have a particular color assigned to them. In case request is made to a salesman for one of these employees, the salesman at once telephones to the exchange operators, the operator in turn rings the gongs and lights the lamp of the particular color assigned to this employee. The person being signalled sees the lighted lamp, and calls the telephone operator to determine at what part of the building his presence is required; by this system, much time is saved both to customers and employees.

There are a number of low-tension systems in the build-

ing operated by a motor-generator set of 110-10 volts, and a set of dry batteries for emergency use. These are quite interesting and useful. They include the fire alarm and the watchman's detector clock, and the telephone system. The fire alarm system is not direct connected to the city fire station; the reason for this is obvious when one considers the unnecessary risk of life by a panic, should a false alarm be turned in by some meddlesome person, a reason which applies in public buildings where large crowds congregate. The system has a break glass station, and the gong, located in the engine room, can be rung not only by breaking the glass cover but also by a key, the latter being used for testing purpose. An annunciator in the engine room indicates the portion of the building from which the alarm has been turned in.

In connection with the usual sprinkler control there is a tank located 130 feet from the level of the street, which has a capacity of 20,000 gallons for fire purposes only. The watchman's detector system consists of a three keys operated station on each floor, and a master station in the store superintendent's office.

The master station has a chart on which are marked the station numbers, and on which lines are drawn representing ten minute intervals. Turning a key in a station transmits an impulse to the meter station, operating a magnet with a pin point on its armature, which punches a hole in the chart. By this method the movements of the watchman are graphically recorded, and his position in the building at any time can be determined at once by a glance at the chart.

There is a very complete telephone system in the store, having eight trunk lines to the city exchange and forty-two local stations throughout the building. In addition there is an order room which is really a small private branch exchange, it being connected by trunk to the store exchange. Customers call the store to give orders, and are at once connected to the order room where efficient clerks note their orders, and then send same to the various departments concerned to be filled. This saves the customer the inconvenience of distributing his or her order over several departments, and the incident trouble and lost time which would arise in obtaining connection with the different departments handling the article desired.

Besides the numerous features described in this article might be mentioned two giant signs, one located on the wall of the main addition, and having 390-25 watt lamps, controlled by a flasher; the other sign is over the Third street entrance of the liquor department, and has 346-4 candle power carbon lamps. There is a total of 8,000 square feet of radition in the store, and 2,000 in the warehouse; the steam used for heating is the exhaust from the turbo-generator; there is a vacum pump located in the basement to keep the heating system free from condensed water. The heating is of the gravity type.

The refrigerating system is the Linde-Canadian patent, and the circulating pump is operated by a thirty horse-power motor connected by silent chain drive; there are three cold storage rooms used for meat and other purposes, and one storage room were furs are stored for the summer. A charge of 5 per cent. of the value of the article is made for six months. There is also a motor-driven air compressor which automatically maintains a pressure of 70 lbs. on the sprinkler system. The cafeteria has a complete line of electrical heaters as well as its own refrigerating room, and a number of fans are located in various places in the dining room so that the temperature is controlled to the satisfaction of the guest.

Winnipeg Municipal System a Splendid Asset*

First Year's Results,—During the period from commencement of operation to May 1st, 1912, when the first fiscal year commenced, 6,686 consumers were connected to our lines. During the first fiscal year a net gain of 15,038 consumers was made, making 21,724 active consumers at April 30th, 1913. At April 30th, 1913, the total deficit, after making full provision for all charges was $142,139.70. This was due to the fact that the same very low rates applied at that time as at present, although only a fraction of the present number of consumers were connected.

Second Year's Result,—The second fiscal year showed a net gain of 7,039 consumers, making 28,763 active consumers at April 30th, 1914. A profit of $60,221.61 was made on the year's business after making full provision for all charges. This reduced the total deficit at that date to $81,917.09.

Third Year's Results,—The third fiscal year showed a net gain of 4,173 consumers, making 32,936 active consumers at April 30th, 1915. A profit of $78,684.72 was made on the year's business after making full provision for all charges. This, together with a correcting entry for $507.20 for the previous year, reduces the total deficit from the commencement of operation up to April 30th, 1915, to $2,725.17, that is, the deficit is practically wiped out and the plant is not only paying its way but is making profits. Not large profits, it is true, because the policy of the city council is to make the rates so low that citizens will receive electric service for actual cost, or as near actual cost as can be given with safety. The comparison of the Winnipeg rates with those applying in any other city on the American continent will show that citizens of Winnipeg are now, and have been for the past three years, getting their electric service at the bare cost of production.

The total cost of our property up-to-date is some seven and one-quarter million dollars. Fixed charges, that is, interest, depreciation and sinking fund, amount to 82 per cent. of the gross expense. The interest rate works out at an average of about four per cent., which is low, much lower in fact than we are likely to obtain money for in the future for extensions to the plant. The annual depreciation and sinking fund together total $275,000.00.

When the plant was first put into operation the opinion was expressed by certain civic officials that no depreciation reserve would be required since the sinking fund levy was quite sufficient to retire all bonds and debentures issued for hydro-electric purposes. Other officials expressed the opinion that in addition to the sinking fund levy there would be set aside annually sufficient money, which in a period of forty years (this being considered the average life of the plant) would be sufficient to rebuild the plant. You will appreciate that these two views were extreme ones, and that while the present generation was in no way obligated to redeem the bonds and also save enough money to build another plant at the end of forty years, that they did owe it to posterity to put enough money aside to take care of renewals which might occur during the life of the debentures. (The issue of the debentures was made forty years since this was estimated the life of the plant). As you will appreciate, however, there are many parts of our plant which will not last forty years, and which will necessitate renewals during

*Extracts from article by R. A. Sara, E. E.

that period. Hence it was deemed advisable to take the cost of the different parts of the plant and allow a certain depreciation reserve for each item according to its estimated life. You will also appreciate the fact that there are certain items of our plant which will not depreciate but will rather appreciate, such as: real estate, on which a quarter of a million dollars has already been spent. It is obvious also that there will be no depreciation on rock excavation from the river bed.

The result of investigation into this question resulted in an annual levy of about four per cent. on the total cost of the property and out of this levy was deducted the sinking fund, which left an amount estimated to be sufficient to liberally cover deferred maintenance, that is, renewals, from time to time, on these parts of the plant whose life will expire before the end of the forty years period. This depreciation reserve is quite separate and in addition to our regular maintenance expenditure, which in itself averages $75,000 per annum.

Err on Side of Safety

This policy of writing off this much money annually seems burdensome during the early years of the plant, but we are erring on the safe side in this matter and this putting aside of a strong reserve represents a policy which is sure to meet with the approval of the citizens in the years to come. If the present rates were onerous in any sense, then the present tax payers might complain about setting aside this reserve fund, but our rates are, as you know, very low compared to other cities.

The cost of the hydro-electric part of our plant totals four and one-quarter million dollars. The total engineering charges work out at about five per cent. of the total cost, which is the amount usually allowed for this item. The total horse power developed up to date is 47,000, which gives us a cost per horse power of $91.00. This figure will compare favorably with other hydro-electric installations. Remember it includes the development up to the 13,000 volt busbar in our terminal station.

There is one item, however, that I wish to call your special attention to. I refer to the discount on debentures, which amounts to about five per cent. on the total cost. No fiscal agent or bond house will ever consider financing a public service corporation without a bond discount. Where the utility is built with private capital under a limited franchise, it will be a good property to secure better than 15 per cent. discount. That means for every $100 worth of debentures issued only $85 goes into the physical property of the plant. With municipally built plants, however, this rate of discount is very much reduced, and you will see that our rate of discount five per cent. gives us a big advantage in the way of raising money, over a private corporation.

Discount on Bonds

The simple conclusion is that if the public utility is a necessity and the money for it obtained in the usual way, one element of cost is the discount on the bonds, which in effect starts the property off with some water in its securities. It is, or is not, water, as you view it. Anyway it is necessary in the ordinary way of financing properties. Thus we are obliged, in determining a reasonable charge for public utility service, to consider not merely the actual cost as I have previously given it, but something more, namely, the face of the securities which command an interest return. Opinions differ on whether it is better for this discount to be absorbed as a capital charge or carried as an interest charge. So far as the purpose of this paper is concerned it is not material, as in either case there must be a charge against earnings to take care of the discount.

The distribution part of our plant has cost up to date nearly three million dollars, and will soon exceed in capital cost the hydro-electric part. It is significant to note that while our hydro-electric plant can deliver some 50,000 h.p. in Winnipeg, the distribution system up to the present time can only handle 35,000 h.p., which means that some $116 per h.p. has been spent on property account for the distribution as compared to $91 for the hydro-electric. It is not hard to see that in years to come as our business develops with the growth of the city, the large item of expense in operating our plant will be confined to the distribution end of the system. Within the next ten years I estimate that the distribution system will have consumed more than double the amount that the hydro-electric plant has required.

It cost $28,500 last year to operate the generating station, $18,000 to operate the transmission line, $30,000 to operate the tramway from Lac du Bonnet to Point du Bois, on which the gross earnings from freight and passenger traffic was approximately $8,000 from other sources than the light and power department. The cost of maintaining and operating the sub-stations in Winnipeg was $34,000, while the distribution system and meters cost $53,000 to operate and maintain. The keeping of consumers' accounts (there are now 32,600 active accounts), reading meters, collecting the accounts and operating the business department cost $76,000 and the general office expenses were $22,000.

A comparison of the balance sheets for the first, second and third fiscal years shows total operating revenues of $544,736.03 for 1913, compared with $865,805.19 for 1914, an increase of 60 per cent., while the operating expenses increased only 41 per cent., from $347,717.40 in 1913 to $490,582.06 in 1914. Practically all this increase in operating expenses is in depreciation for which $130,000 more was allowed in 1914 than in 1913. For the third fiscal year, the operating revenues totalled $971,839.79, an increase of over 12 per cent. over the preceding year, despite the fact that nine months of the third fiscal year were subsequent to the declaration of war. The net result of the first fiscal year's operation was a loss of $83,297.96, the second fiscal year showed a profit of $81,897.96, and the third fiscal year showed a profit of $78,684.72. The net deficit was thus reduced from $142,139.70 as at April 30th, 1913, to $81,917.09 at April 30th, 1914, and was again reduced to $2,725.17 as at April 30th, 1915. That is, the deficit has been practically paid off from earnings.

More Than Paying Its Way

Thus the city light and power plant is now not only paying its way after making full provision for all charges including interest, depreciation and sinking fund, but it has already paid off a deficit of one-eighth of a million dollars incurred during the first year and a half's operation when energy was sold at the same rates which apply to-day, but the business was carried at a loss because there was not sufficient of it to make it pay.

With 100,000 horse power available when required, with an established electric utility already on a profit-making basis, with rates as low, if not lower, on the average, than any other Canadian city, and with absolute control of the local electrical situation and the regulation of rates, Winnipeg is in an advantageous position electrically.

The 100,000 horse power of electrical energy under the control of the city is far greater than the total water power developed at Lowell, Lawrence and Holyoke, in Massachusetts, and Manchester in New Hampshire, four industrial cities having water-powers as their "raison d'etre." The industrial centres developed at Niagara Falls, Shawinigan and the Sault are Canadian examples of the congregation of manufacturing establishments where low priced power is available.

Winnipeg faces the future with the confidence inspired by knowledge of ability to supply in fullest measure the requirements of the industries which form the basis of all metropolitan growth.

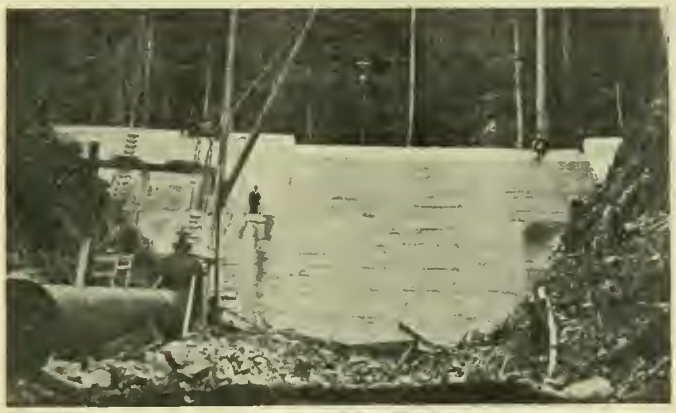
Substantial Developments in Prince Rupert*

The development of Prince Rupert since I arrived here in July, 1912, has been along conservative and substantial lines. At that time the town was about two years old and had a population of a little over 5,000 people. There was still a good deal of development work being carried out by the Grand Trunk Pacific Railway Company, and the city had spent a considerable sum of money in making permanent streets in the business section and plank roadways to the outlying parts. Real estate offices were very much in evidence, and one was told that within five years we would have Vancouver put in the shade! A large portion of the city's money was, in my opinion, very wisely spent in the acquirement of the utilities. The city owns and operates its own electric light and power system, telephone system and waterworks, and has made provision for extending these systems to take care of a city of upwards of 200,000 people. Prince Rupert is so situated that there is every reason to believe the population may some day reach that mark. We have to the east of us, along the line of the Grand Trunk Pacific, thousands of square miles of good agricultural land, a big mining district which is being developed on a permanent basis and millions of feet of timber with good waterways to reach the timber limits.

Our harbour is one of the best on the coast and our geographical position has already been the means of starting a big fishing industry which will ultimately become one of the city's biggest assets, and also makes Prince Rupert Canada's gateway to the east. While the real estate boom, which was at its height in 1913, is now something of the past, the city has had no serious setback. The business of the port is gradually increasing and on a firm basis.

We have now the largest cold storage plant on the coast, and a dry-dock fully equipped for building or repairing ships up to 20,000 tons capacity. The Imperial Oil Company has this year built a dock and erected five large oil tanks for storage of oil to supply the shipping and railway with fuel.

In the electrical field the development has been very rapid. When the city was incorporated in 1910 they purchased four second-hand boilers and an old 160 h.p. high pressure engine. They also purchased a 100 kv.a. generator for belt drive which was connected up to this old engine. Lines were built in the town and the business grew so rapidly that in 1912 they had to install two more 100 kv.a. generators with more up-to-date engines to drive them. By the end of 1913 these were overloaded, and in the spring of 1914 we started our Lake Woodworth hydro-electric development. We have in that plant a 1,650 h.p. unit which, however, is not overloaded yet, but this year we secured the water rights on Thume River, a stream about twenty miles distant from the city, which, it is estimated, is large enough to develop 10,000 h.p. continuous. It is not the intention of the city to develop this power at once, but it was necessary to procure the rights for future use. We hope some day to have a 25,000 h.p. electric plant on this stream. The stream is about thirty miles from the open sea but the waterway leading to it is navigable for coast steamers to the power site. With a dam 30 feet high we get a 300-foot head and about 6,000 acre feet of storage. With a 1,500-foot pipe line the



Lake Woodworth Dam—Prince Rupert, B. C.

power house can be built on salt-water level and the machinery can be placed with the ships gear where we can reach it with the power house crane.

The dry-dock has one of the most up-to-date electrical installations in the country. In the power house they have two 1,000 kw. direct-connected steam turbo-units, 2200 volt, 60 cycle, 3600 r.p.m.; three 35 kw. steam turbo-exciters; one 25 kw. motor-generator set, and a twenty-panel switchboard with all the latest instruments and switching devices.

Installed in the different buildings and on the pontoons there is a total of 1,500 h.p. in motors, made up of fifty motors ranging from 10 h.p. to 200 h.p., both a.c. and d.c. The distribution system between the buildings consists of two and one-half miles of underground, three conductor, 2200 volt lead

*By T. C. Duncan, Superintendent Electric Light Dept.; Manager Teledhone Dept.

General view of the Prince Rupert dry dock.—Power house shown in centre background.

covered cable, small fireproof sub-stations containing in all 41 transformers with a total capacity of 1,600 kv.a. and equipped with slate switchboard panels and automatic oil switches for the 2200 volt circuit. All secondary switches and automatic control devices are of the latest design. The large pier derrick is equipped with two 50 h.p. motors and one 25 h.p. motor and has a lifting capacity of 50 tons. The pontoons have four 100 h.p. and two 200 h.p. variable speed motors with Cutler Hammer automatic magnet control for operating the pumps; also three 90 h.p. motors for driving the air compressors which will supply air for all the pneumatic tools used in connection with the ship repairs. The dock is also supplied with power for electric tools through extra flexible weatherproof three-conductor cable suspended from goose necks located on the edge of the piers.

From the foregoing outline of Prince Rupert's development it is obvious that the builders of the city are keeping their eyes steadily fixed on the future. The city was originally laid out by experts in townsite surveying and, ever since, the Government, the Grand Trunk Pacific and the Municipality have laid out their work to meet the requirements of Prince Rupert's growth into a large city.

Up-to-date Fire Alarm System in City of Winnipeg

The earliest fire alarm system in use in Winnipeg was prior to the introduction of telephones when a few boxes were installed by the late Mr. Jas. Yuill, the wires being strung on the roofs of buildings. On the advent of the telephone, arrangements were made for the system to be rebuilt and operated by the Bell Telephone Co., who continued to operate it until the expiration of their contract in 1902. The city council in line with its well known policy of public ownership and operation of public services, instructed the city electrician to prepare plans and estimates for a new fire alarm system. These were presented and adopted in spring, 1902.

At the time the city arranged to take over the franchise there were in service seventy-six public street boxes, the property of the city, also seven private boxes on the premises of the railway companies, etc. The number of boxes connected to the system in July, 1915 is 360, of which twenty-two are privately owned, but operated on regular city circuits. The city makes a fixed charge for the operation of private fire alarm boxes, and from this source has to date collected $10,533.00. The receipts from this source were formerly applied to general revenue account but they are now devoted to extensions and improvements of the system.

The system has grown in a corresponding manner in regard to fire alarm service furnished the fire hall, water works,, etc. When taken over, there were three fire halls and one water works pump house supply. Service is now given to fifteen fire halls, three pump houses, two electric power plants and three police stations.

The growth of the system as noted necessitated a large increase in the mileage of the street circuits, and as the entire system of street wiring was carried overhead, the problem of obtaining safe operating conditions became acute. It must be borne in mind that a fire alarm system of wiring is always arranged on the "series" plan in which a single wire runs out from the office from box to box around the circuit and then back again. Each of the old circuits averaged ten miles in length. Should a wire break at any one point on the circuit, all the boxes on that circuit are entirely useless for alarm purposes until the break is found and repaired.

The logical way to reduce this danger was to install underground cables and shorten up the circuits. Fortunately this had been prepared for, to a considerable extent, through the arrangement made in 1907 with the Government of Manitoba whereby the government when laying its telephone conduit system also laid certain additional ducts for the city. At the time of considering the question of underground cables, the city had in the government system a total of 58,716 feet of underground ducts all ready and waiting for the cables. At this time also, the police commission had obtained the city council's approval of the plans of their proposed police signal system. Ultimately the council gave instructions for the preparation of plans for a complete cable system for both fire and police telegraph cable systems. In this way considerable economy was reached in expenditure on both ducts and cables as the two systems although using entirely separate wires are mostly grouped in the one cable and occupy the same ducts.

The old fire alarm system was operated from the central fire hall—this building situated in the centre of a congested business district and being anything but fireproof was not considered a safe location for the installation of the new system apparatus. It would be paradoxical to spend a large sum of money on a fire alarm system, and then have it endangered from fire as was actually the case during the Ashdown-Bulman fire. This fact together with the necessity for additional space for the proposed police patrol and signal system led the council to purchase a site adjoining the central police station, Rupert street, on which was erected a fireproof building, the top flat of which is used exclusively for the central office equipment of the two signal systems. This had to be definitely decided before the conduit and cable systems could be laid out on paper, a task which involved a great deal of study owing to the numerous details connected with the two systems. It was then found that some 57,000 additional duct feet of conduit would be required to complete the underground system. Where possible this space was purchased from the government, but a considerable amount had to be specially laid. The total duct feet of conduit is now 115,718 without counting laterals to poles, pedestals or buildings. No part of the police or fire cable system is carried in or through light or power conduits, the government and the city mutually agreeing not to permit this practice.

The underground cables were supplied and laid by the Standard Underground Cable Co., which on the fire alarm system alone totalled 73,103 lineal feet of cable of various sizes. In addition the Siemens Co. supplied 34,972 feet of aerial cable. This made a length of fire alarm cable totalling 108,135 feet.

The underground cable distribution comprises "trunk" cables running from the central office to the fire halls, No.'s 1 to 7 inclusive, also underground "box" circuit cables to fire boxes in the inner radius of the city. The box circuits other than those in the inner radius are all brought into one or another of the above fire halls either by all overhead wiring or part cable and part overhead; the circuits are then grouped and brought to the central office by means of the "trunk" cables. The gong or alarm circuits are likewise carried underground to the above-mentioned halls, and from out of same by means of underground and overhead cable to the fire halls 8 to 15.

While much of the apparatus is of the well-known Gamewell standard, some departures from arrangements usually found in offices have been made. For instance the

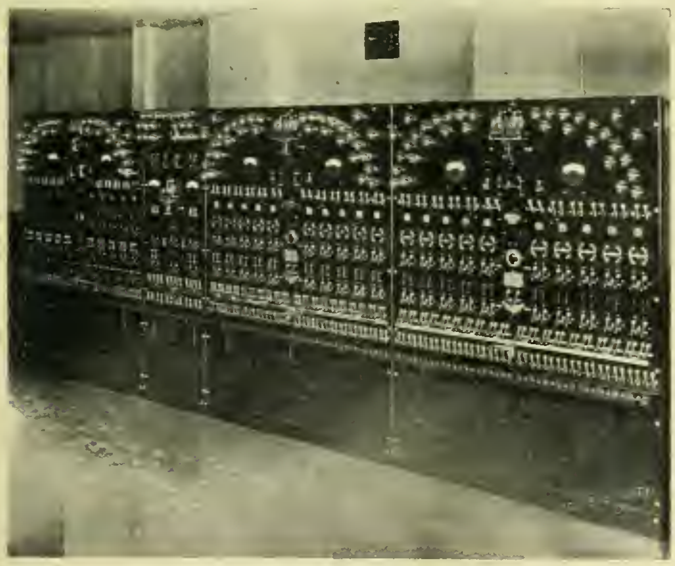
"fast time" circuits are not used for routine departmental work as is usually the case—this function is performed by the "slow time" circuits for this purpose, utilizing the principle of current "weakening" but not "opening" when using the line for telegraph purposes. This keeps the fast time circuits free from complications and always at liberty for their true purpose. The apparatus furnished under the contract, includes the following: Main line switchboard for 20 circuits; fast and slow time switchboards for 10 circuits; battery charging switchboards for 30 circuits; rectifier and local circuit switchboards. All these boards are of blue Vermont marble impregnated black, and, with the highly polished metal of the apparatus, present a striking appearance.

The main line relay board comprises protective devices and indicators for all the outside lines, also milliampere meter for each line, relay for actuating register, and other appartus together with keys and various individual and gang switches. A ruby bullseye indicator system is so arranged that on alarm coming in, the particular circuit concerned is indicated by a light flashing behind the ruby glass, also disclosing the number of the circuit.

The fast time and slow time board are fitted up in a similar manner as far as their particular functions admit together with the apparatus peculiar to their duty.

The storage battery boards take care of the manipulation of the various batteries, two sets of battery being apportioned to each circuit, one set being charged while the other is working. The batteries can be changed in various combinations of series or multiplex, the d. c. current being supplied through a rectifier mounted on a separate panel. This has in turn two sources of supply on a. c. side from both the Winnipeg Electric Railway Co. and the city lines.

All alarms arriving are recorded by puncturing registers. These are of the four-circuit type; they are also simultaneously recorded on a recording register tape and time



Storage battery switchboards—Winnipeg Fire Alarm System.

stamped; outgoing alarms are also recorded and stamped. All the time stamps as well as the secondary clock are actuated by a standard time clock common to both fire and police systems, thus insuring absolutely uniform time stamping.

Three methods of transmission of alarms are possible, viz; by throwing into combination a box circuit with the fast time circuits; by means of a multiple tapper key or by the manual transmitter; the latter is arranged to transmti signals over ten fast and ten slow time circuits. All the register transmitter and recording sets are mounted on white marble bases supported upon art metal cabinets, the entire equipment being absolutely fireproof throughout, no woodwork of any kind being used.

The battery room is located in the rear of the main operating room, and is common to both fire and police system. The batteries for the fire system comprise 1,562 cells, the elements being of the "Fuller" type, each element being of triangular form wrapped with glass wool and surrounded by perforated ebonite sheeting. This type of cell possesses properties rendering it highly suitable for fire alarm work. All the elements were manufactured in

Main line relay, fast and slow time boards, &c.

Winnipeg by the Fuller Storage Battery Co., and are of nine ampere hour capacity.

In addition to the above the office also contains a private branch exchange telephone board of special design for the department work; central office receiving apparatus of the May Oatway fire alarm system to which there are now connected forty-three subscribers' premises, and also the receiving apparatus of the Dominion Messenger & Signal Company, with fifty-six subscribers. The total number of alarms handled from all sources last year being 1,226.

The task of designing, building, operating and maintaining two systems of this kind in such a way as to suit the requirements of both fire and police department chiefs, and at the same time produce smooth running results coupled with economy is a complex problem. Mr. Cambridge, city electrician, has, however, demonstrated that this can be done. The city electrician is appointed by council and is subject to it; his staff looks after the testing and general upkeep of both systems, the fire alarm operators are also members of his staff, but are subject to instruction of the fire chief as to handling alarms. The police operators are appointed by the police chief, their duties being confined to receiving and transmitting signals, handling the police telephone board and flash bell system but not to testing. A chief operator, Mr. J. S. Henry, a member of the electric department staff, supervises both systems. This arrangement gives the fire and police chiefs all necessary control without throwing burdens of engineering and technical nature upon them, and has worked in a manner satisfactory to all parties.

Engineers and surveyors have recently been engaged making preliminary surveys on the proposed hydro-electric development in the western portion of the town of Kenora.

Montreal Conduits Plans Criticized

The plans for certain conduits in the St. Lawrence Boulevard district were attacked at a meeting of the Quebec Public Utilities Commission, held on July 14. The criticism of the plans was voiced by Mr. K. B. Thornton, chief engineer of the Montreal Public Service Corporation, whose contention was that the plans are piecemeal, and drawn up without sufficient consideration of the requirements of the different companies interested. He also strongly objected to having fire alarm and police call signal cables placed in the same conduits as the cables for light and power. Mr. P. W. Sothman also criticised the plans, and endorsed Mr. Thornton's view that separate systems of conduits should be installed. He was of opinion that the congestion of wires carrying many different voltages might cause very extensive trouble in case of a big burn-out of any single wire. Mr. R. S. Kelsch, one of the electrical commissioners, cross-examined Mr. Sothman at great length as to the validity of his criticism; the latter emphasized the point that the plans should have been drawn up on a general scheme, and not for various districts which would have to be linked together at a later date. The plans ought to be based on the growth of the city for at least fifteen years.

Mr. Kelsch stated during his cross-examination that burn-outs of high voltage wires in Montreal conduits had occurred at different times in recent years, but that never had such accidents caused extensive trouble in these conduits.

The chairman of the Public Utilities Commission, Lt.-Col. F. W. Hibbard, said the position was that meetings had been held at which no demand for this plan of double man-holes had been presented, but now this had been made. The engineers for the companies admitted they had been wrong in approving the earlier plans, and now wished to have them modified. This was a matter entailing considerable work and expense, and needed consideration.

Prof. L. A. Herdt, chairman of the electrical commission, remarked that his commission had no objection to the double system if the companies wanted it, but such a change would entail much difficulty and cost. He suggested that it would be better for the electrical commission to meet the representatives of the interested companies, and talk things over. This was agreed to.

Before adjourning, however, Mr. Kelsch expressed in emphatic terms his amazement at the attacks upon the electrical commission. The companies, he said, had the power to ask for separate conduits, and if refused could appeal to the utilities commission. Yet the companies had never asked for these separate conduits and had agreed to the plans proposed. "Now they suddenly change their views and come here with these criticisms and demands for the separate conduits. I can only repeat that I am amazed."

Mr. Perron, K. C., disclaimed any intention of attacking the electrical commission; all that was asked was that the conduits should be made as perfect as possible.

Will Operate on Big Scale

The Public Service Corporation of Quebec is the name of the new hydro-electric company recently incorporated with a provincial charter to supply light and power to the cities of Quebec and Three Rivers and to operate in several adjoining counties. The corporation have, through Mr. C. H. Branchaud, of Montreal, purchased by public auction for $100,000 the assets and contracts of the Dorchester Electric Company, and have contracted with the Shawinigan Water and Power Company for the latter to supply all the power needed. This will involve the building by the Shawinigan Company of a transmission line to Quebec, and it is expected that it will be completed early in the fall. It is intended to overhaul the present steam plant of the Dorchester Company and to use it as an auxiliary.

Mr. Conway Moving East

Mr. G. R. G. Conway, for a number of years chief engineer of the British Columbia Electric Railway Company, has resigned his position and will open an office in Toronto as consulting engineer. Mr. Conway has successfully carried out a number of large undertakings for the B. C. E. R. Company, including the construction of the great Coquitlam dam, the largest of its type in Canada; the enlargement of the company's power house at Lake Buntzen; the planning of a new power house of approximately 45,000 h.p. capacity; the enlargement of the Jordan River plant in Vancouver Island; the construction of the steam auxiliary plant on the Island, and so on, involving a total expenditure in the last four years of between seventeen and eighteen million dollars. In addition Mr. Conway has shown a whole-hearted interest in public measures, as, for example, acting as chairman of the commission appointed to prepare plans for a great civic centre for the city of Vancouver. Mr. Conway was given a complimentary banquet on June 26th at Hotel Vancouver by the management and officials of the B. C. E. R. Company.

Mr. G. R. G. Conway.

Mr. Conway was educated at Hartley University College, Southampton, entering later the office of Mr. Jas. Mansergh, F. R. S., of Westminster, London. In 1898 he was appointed resident engineer of the city of Aberdeen, which position he held for eight years, when he was appointed by Mackenzie & Mann as chief engineer of the Monteray Light & Power Company. From Monteray Mr. Conway came to the B. C. E. R. Company in 1910.

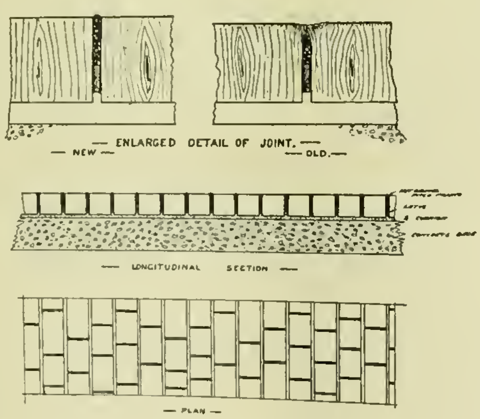
Mr. Conway is a member of the Council of the Canadian Society of Civil Engineers, member of the Institute of Civil Engineers, member of the American Society of Civil Engineers, member of the Institution of Mechanical Engineers of London, member of the American Society of Mechanical Engineers, Fellow of the Royal Meteorological Society, member of the British Institute of Water Engineers, member of the American Water Works Association. During his residence in British Columbia he has served a term as chairman of the Vancouver branch of the Canadian Society of Civil Engineers. We understand that Mr. Conway will be retained by his old company in the capacity of consultant.

Electric Railways

Wood Block Paving on Railway Lines in British Columbia

The accompanying illustrations represent interesting features of wood block paving on electric railway street lines in South Vancouver, B.C. During the summer of 1914, the municipal council of South Vancouver paved Main Street between 16th and 51st Avenues,—a stretch of road 2 miles long by 54 ft. wide—with wood blocks cut, prepared and laid by the Dominion Creosoting Company. The work specified 4-inch wood block, saturated with 10 lbs. of creosote to the cubic foot, to be laid on a 6-inch concrete base, with a 1-inch cement and sand cushion between the concrete and the wood blocks. This pavement is guaranteed for 15 years and is looked upon as a great local achievement, as it has been made entirely from B. C. fir, B. C. cement, and B. C. creosote manufactured in a B. C. factory. It is one of the largest permanent paving works undertaken in the province and employed 250 men for some 40 weeks.

The roadway was built by what is known as "lath construction." This leaves a space of from ¼ to ⅜ of an inch between the blocks, which is then filled with hot gravel and covered immediately with a preparation of bitumen at a temperature of 300 deg. Fahr. After this mixture has percolated into the joints, a further squeezee coat was poured over the blocks to fill up all the interstices. Finally, a thin coating of fine gravel was spread over the surface.

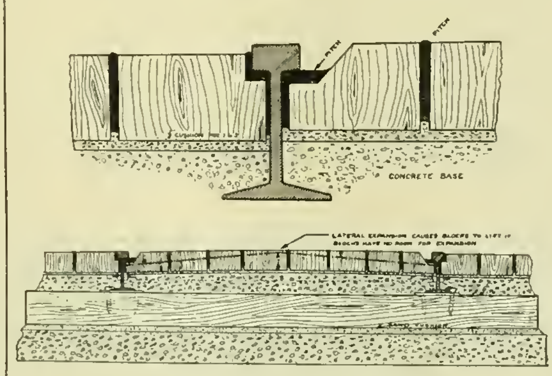


WOOD BLOCK PAVEMENT
LATH JOINT CONSTRUCTION

As will be seen from the drawings, special gauge blocks were used between the rails and over the fish plates long blocks of special hard wood were placed, the blocks being slightly longer than the fish plates and purposely drilled and bevelled to receive the nuts which jointed the rails. This was considered one of the special features on this class of work, as carried out in South Vancouver.

The wood blocks were rigidly inspected at the works during treatment, and notes were taken of the time under treatment, the contents of the charge and the amount of oil absorbed and the temperature and pressure maintained.

With respect to oil penetration, the standard can only be regarded as an average one on account of the wide difference in the density of the fir wood. It was found, however, on examination of the various exhibits, that the blocks after treatment showing an average penetration of from 1 to 1½ inches had shown at the end of sixty days a thorough penetration, and often a well-saturated block.



DETAILS OF TRACK CONSTRUCTION
WOOD BLOCK PAVEMENT.

The mode of lath construction of wood block pavement is shown in detail in the diagram herewith. The lath joint gives plenty of room for expansion, besides binding the blocks together, as the mortar joins the bricks together in the building of a wall.


Laying blocks between rails.

Government Publishes Canadian Railway Statistics

The annual report of the Ottawa Department of Railways and Canals for the year ended June 30th, 1914, covering railway statistics of the Dominion of Canada, has just been issued. The section which deals with electric railways contains interesting information on Canada's sixty electric railways, which now have a total mileage of 2,053, single track. The total car mileage for the period covered was 98,917,808; total passengers carried, 794,059,593.

The total capitalization of our railways is placed at $147,595,342, made up of $81,284,244 in bonds and $66,311,098 in stocks. The total net earnings for the year covered amounted to $7,867,546, and the surplus after all deductions, to $1,873,955. A regrettable percentage of our systems show a deficit, this number amounting to no less than 20, or one-third of the total. Some interesting figures are given in the accompanying table:—

Name of Railway.	Total Mileage Single Track.	Total Car Mileage.	Total Passengers Carried.	Bonds	Bonds per mile of Line.	Stock.	Total Capital per mile of Line.
Berlin and Waterloo	5.14	261,328	1,192,886	161,844	31,797	....	31,797
Berlin and Northern	2.55	33,500	199,819	2,400	942	17,400	7,767
Berlin, Waterloo, Wellesley and Lake Huron	26.42	406,393	1,327,995	426,000	16,124	125,000	20,855
Brandon Municipal	8.50	269,679	916,723	450,000	52,941	....	52,941
Brantford and Hamilton	23.00	364,125	584,627	660,000	28,695	300,000	41,739
British Columbia	344.61	13,030,262	63,494,038	6,827,000	19,812	9,173,000	46,431
Calgary Municipal	71.56	3,213,632	24,037,860	2,280,210	31,891	....	31,891
Canadian Resources Development	1.91	35,843	17,565	....	......	48,600	25,450
Cape Breton	31.62	673,262	4,232,485	988,000	32,385	1,359,000	49,108
Leased—Sydney and Glace Bay				402,000	21,978	500,000	48,716
Chatham, Wallaceburg and Lake Erie	40.60	325,277	434,646	800,000	21,657	760,600	40,391
Cornwall	6.50	216,742	452,789	....	......	200,000	30,769
Edmonton Interurban*	8.69	8,096	10,726	....	......	600,000	69,045
Edmonton Radial	52.64	2,044,286	17,090,450	3,004,388	57,075	....	57,075
Ft. William Terminal Ry. & Bridge Co.				....	......	12,500	......
Fort William	11.63	....	1,658,943	1,100,000	......	....	......
Grand Valley	42.31	491,388	1,775,756	688,800	17,036	1,100,000	43,035
Guelph Radial	8.83	249,000	1,345,150	....	......	151,500	17,158
Halifax Electric	21.62	1,275,527	7,457,064	600,000	27,752	1,400,000	92,527
Hamilton and Dundas	7.00	147,289	835,793	100,000	14,286	100,000	28,572
Hamilton, Grimsby and Beamsville	22.00	414,731	782,530	150,000	6,818	235,000	17,500
Hamilton	22.00	2,230,370	20,649,522	480,000	21,818	914,000	63,364
Hamilton Radial	33.69	552,421	2,031,674	160,000	6,40[illegible]	111,150	9,699
Hull	31.31	840,355	2,498,171	....	......	292,000	9,326
International Transit	4.52	306,246	1,890,422	220,000	8,673	150,000	81,859
Kingston, Portsmouth and Cataraqui	8.00	199,680	1,348,604	99,250	12,406	83,100	22,794
Lethbridge Municipal	11.70	423,665	1,432,995	408,877	34,946	....	34,946
Levis County	23.50	418,056	2,217,837	151,100	6,429	407,900	23,786
London Street	33.25	1,757,518	11,051,952	650,000	19,549	556,000	36,271
London and Lake Erie Railway and Transportation Co.	29.50	412,763	680,549	700,000	24,121	2,000,000	91,918
Moncton Tramways	3.50	97,520	468,751	400,000	114,286	1,125,400	435,829
Montreal Tramways†	233.49	18,144,098	221,[illegible]049	33,267,150	142,477	3,000,000	155,326
Montreal and Southern Counties	36.84	533,122	1,915,369	....	......	1,000,000	27,144
Moose Jaw	12.00	579,607	2,639,030	....	......	679,620	56,635
Nelson	3.90	13,301	145,230	....	......	81,000	20,769
Niagara Falls, Park and River	24.54	295,048	1,451,699	600,000	24,450	....	24,450
Niagara, St. Catharines and Toronto	79.87	1,074,077	4,684,554	1,098,000	13,747	925,000	25,328
Niagara, Welland and Lake Erie	2.04	86,892	458,450	45,500	22,303	250,000	144,852
Nipissing Central	13.65	233,773	1,347,081	....	......	530,000	38,827
Oshawa	13.00	98,536	251,138	78,452	6,035	40,000	9,112
Ottawa	50.70	4,840,795	31,917,076	477,000	9,408	1,876,000	46,482
Peterborough Radial	6.08	280,092	1,214,387	136,256	22,410	100,000	38,857
Port Arthur	18.34	329,451	1,616,943	816,488	44,519	....	44,519
Pictou County‡	8.10	135,662	1,171,470	300,000	37,037	300,000	74,074
Quebec Ry., L. H. & P. Co.—(Citadel)	19.77	2,125,963	13,562,429	2,513,434	41,089	3,250,000	94,221
(Montmorency)	41.40	454,606	1,721,079	(Included in above)			
Regina Municipal	33.00	1,157,330	5,720,400	1,475,000	44,697	....	44,697
Sandwich, Windsor and Amherstburg	39.93	1,040,413	5,802,073	600,000	15,026	297,000	22,464
Sarnia	9.25	167,662	1,166,209	80,000	8,648	90,000	18,486
Sherbrooke	9.53	443,436	1,306,817	1,090,500	114,429	1,090,500	228,858
St. John, N.B.†	19.00	1,003,454	5,903,269	1,000,000	52,631	800,000	94,736
St. Stephen	7.00	183,960	751,486	100,000	14,286	100,000	28,472
St. Thomas	7.00	295,785	745,233	65,000	9,286	....	9,286
Suburban Rap. Transit Co. (Winnipeg)	19.65	254,083	1,152,252	500,000	25,445	100,000	30,529
Saskatoon Municipal	16.28	684,099	4,005,063	713,688	43,838	....	43,838
Toronto	132.62	22,464,665	220,683,726	3,987,207	30,065	11,850,925	119,425
Toronto Suburban	10.26	341,428	2,529,560	2,628,000	30,000	1,500,000	176,140
Toronto and York	82.00	1,523,702	6,280,595	1,640,000	20,000	2,000,000	44,390
Windsor, Essex and Lake Shore	39.16	363,030	525,195	750,000	19,152	750,000	38,302
Winnipeg Electric	100.87	8,653,005	79,165,581	5,000,000	49,569	13,374,603	182,161
Winnipeg, Selkirk and Lake Winnipeg	22.13	354,803	615,134	400,000	18,691	111,500	23,729
Yarmouth‡	3.00	62,976	151,694	12,700	4,233	54,500	22,400
Total	2,052.44	98,917,808	794,059,593	81,284,244	......	66,311,098	......

*Month of June. †1911 Figures. ‡1912 Figures.

The Dealer and Contractor

Timely Window Displays—Your Window is a Valuable Asset—Make it Pay You Dividends

Timely holiday advertising is one of the most effective methods of exploiting the advantages of electrical household appliances, first, because the public is in a receptive mood,—looking to be entertained and interested, and, second, because the holiday furnishes a background, an appropriate setting, to the display, which every passer-by is quick to recognize. The illustration herewith is merely suggestive of windows that may be worked out, with a little expense and ingenuity, on our Canadian holidays. This window was used to good effect in a number of United States electrical stores on their recent Independence holiday. Such windows are doubtless the means of impressing on the minds of hundreds of passers-by the advantages of electricity in the home. They carry away impressions they cannot forget and eventually, if not immediately, they become purchasers.

This display can be installed in a very short time and at very little expense. In the background two danger signals are shown, which can be cut from card-board and painted in red and black. The wreaths and eagles shown on the border of the background, which would be replaced, of course, by maple leaves or some other suitable emblem, can be cut from crepe paper made for this purpose; this may be purchased at any stationery or department store for a few cents. The feature of this display is the "Dorothy," cutout holding a shield-shaped card containing the slogan, "Safe and Sane,—no Soot, no Flame." The shield is cut from heavy card-board and the letters pasted or painted on it. This placard

A window that carries suggestions for Canadian patriotic holidays.

attracts the attention of the passer-by and the danger signals help to connect the mind with the selling argument of the display. The flag is draped over two small pedestals, which may be empty store boxes, on which the two fans are displayed. Great care must be taken to obtain a proper grouping of the appliances. Don't crowd your window. An artistic effect is essential in order to give a pleasing appearance to the general display.

Keep Monday, Sept. 6, Free for Convention

The electrical contractors of Ontario will hold a convention in Toronto on Monday and Tuesday, September 6th and 7th. Do you get that? Keep those dates open and let nothing short of a serious illness prevent your attendance.

Following a vigorous campaign by the Toronto Electrical Dealers' and Contractors' Section of the Retail Merchants' Association of Canada, as described in the last issue of the Electrical News, replies have been received in such numbers and so universally favorable in tone, that the success of the convention seems assured and the committee having this matter in charge have decided to go ahead with it.. A tentative program has been drawn up and will be widely distributed in a few days among the contracting fraternity for suggestions and criticisms.

It has also been decided to hold a manufacturers' and jobbers' exhibit in connection with the convention, so that these firms may have an opportunity of meeting their customers at first hand and demonstrating their various lines.

In addition to the paper program and the exhibit, it is proposed also that the proceedings include an informal luncheon or banquet, where the delegates may meet in a social way and spend a little time getting acquainted.

As noted above, the replies, nearly 100 to date, have been uniformly favorable in tone. We print half a dozen typical answers below. If your enthusiasm did not carry you to the point of sending in your reply to the secretary, no doubt these letters voice your sentiments just the same. Now is the chance for Ontario electrical contractors to get together and—co-operate. There are many obstacles in the way of your success that you cannot remove single-handed. Hundreds of electrical contractors have been trying it in the past, —and failed. Now we are going to try it,—all together. Make a point of attending this convention, if you have to put off your hunting trip. Divided we have fallen time and again, but united, we are going to stand up—and make ourselves heard. Read these replies and make your resolve on the instant that nothing short of physical incapacity will keep you away from Toronto and from this convention on September 6th and 7th. These half dozen cards were picked at random,—

Belleville, Ont.

Dear Sir:—

I believe that it would be a good plan to hold a convention and would try and be on hand. The electrical retailers and contractors need some protection against the irresponsible workman and against the tendency of power companies to get work in in any way so as to secure power customers.

Yours truly,

Greenleaf & Son.

St. Catharines, Ont.

Dear Sir:—

Re convention Labor day. Yes, I think I can and will if possible. I quite agree with your proposition for the electrical trades to get busy and work together.

The Martin Electric Company,

(Signed) F. W. Martin.

Kingston, Ont.

Dear Sir:—

We will endeavor to have our firm represented at the convention at Exhibition time.

Yours truly,

H. W. Newman Electric Company.

Per H. W. N.

Stratford, Ont.

Dear Sir:—

Do certainly endorse suggestions as set forth in your circular letter and would be pleased to attend any meeting or convention held during Fair time, which would have as an object "the betterment of electric contracting conditions generally."

Fraternally yours,

F. C. Whatmough.

Goderich, Ont.

Dear Sir:—

Your letter of the 20th appeals to me very strongly and if you go on with it I will endeavor to be there.

Yours truly,

Chas. C. Lee.

London, Ont.

Dear Sir:—

Kindly count us in with the boys. Whatever they do will be perfectly satisfactory to us.

If possible one of us will be in Toronto at date suggested.

Wishing you every success, and assuring you of a hearty co-operation in the matter, we remain,

Very truly yours,

Benson-Wilcox Electric Company.

(Signed) H. S. Wilcox.

Electrical Prosperity Week

The plans are gradually being perfected under the auspices of the Society for Electrical Development, to give continent-wide publicity to "Electrical Prosperity Week," which has been fixed for November 9th to December 4th inclusive. As already announced, this is an event inaugurated by the various electrical interests of the United States, and between now and the above date every effective agency will be employed toward making Electrical Prosperity week an unqualified success. The co-operation of every organization connected in any way with the electrical industry has been assured,—central stations, manufacturers, electrical jobbers, electrical contractors, electrical dealers, electrical organizations of every sort, all will add their influence and enthusiasm to the common end.

A most systematic scheme of publicity will be inaugurated, not only to the end that everyone may know about this event, but that they may be so enthused about it as to give their undivided support. A special folder will be addressed to the public explaining the purpose of the "Week," emphasizing what electricity has done for humanity and what it can do. The Electrical Prosperity Week "design," as illustrated herewith, will be furnished in the form of an eight-sheet bill poster, 8 ft. 10 in. high by 6 ft. 8 in. wide, lithographed in six colors.

These will be furnished free of charge to members of the Society, and at actual cost to others. A reproduction of this bill poster, 24 by 32 in., will be furnished for window displays, also in six colors. Poster stamps will be distributed containing the same design. Street car cards printed in colors will be used. Electrotypes and copy for advertisements will be supplied by the advertising staff of the Society, so that a continental advertising campaign will be carried out in the press and in the various electrical trade journals.

In addition to this, electrical manufacturers and jobbers will feature the "Week" heavily in their advertising in the trade journals, as well as in certain popular magazines. Special articles will be published in the editorial columns of various papers and magazines. Feature reels will be presented in moving picture theatres, and a series of booklets on "How to put on an electrical parade," "How to put on a demonstration," and so on, will be issued.

The co-operation of every electrical man is expected. "Doing it electrically" is a slogan justified by facts and results. If all will unite in advertising and boosting Electrical Prosperity Week, "Doing it electrically" will be a fact in many homes where electricity is now only spoken of as a possibility of the future.

Federal Agencies carrying nice line

One of the Western supply houses carrying a nice line of electrical goods is the Federal Agencies, Winnipeg, of which Mr. A. L. Woolf is Manager. Mr. Woolf tells us that even in these times he occasionally picks up an order which looks like real business. His agencies include the Flexible Conduit Company, Guelph, Ont., "Canadian Queen" irons and toasters and "Best Quality" loom; Munder Tungsten Lamp Company, Guelph, Ont., tungsten lamps; Menominee Electric Manufacturing Company, Menominee, Mich., motors, fans, telephones, batteries, etc.; Thomas & Petro, Watertown, Wis., safety rail anchors, and the Crown Novelty Company, Chicago, Ill., portable lamps. They also represent Messrs. Griffith Bros. & Company, London, England, for their paints, varnishes, and enamels. Their offices and warehouse are located at 56 Albert Street.

They are not "just as good"

Messrs. Spielmann Agencies Regd., Montreal, are sending out warnings to their customers to the effect that, owing to the world-wide reputation and success of Griffiths Bros.' "Anti-Sulphuric" Enamel, unscrupulous competitors have attempted from time to time to benefit from this reputation by placing on the market imitations with deceptive labels, closely imitating the name under which Griffiths Bros.' preparation has been favorably known for so long; and some firms have even gone so far as to call their imitations by Griffiths Bros.' trade name. Messrs. Griffiths Bros. & Company have manufactured "Anti-Sulphuric" Enamel for twenty-five years past, in London, England, and have created a world-wide demand for this unique preparation. It is used in large quantities in the British and Japanese Navies, and by electrical companies, railroads, etc., all over the world. Its uses are not confined to electrical work, as "Anti-Sulphuric" Enamel is in demand by sugar refineries, paper mills, shipbuilders, ammunition factories, nickel-plating works, etc.

Many happy returns

The Mainer Electric Company, Limited, of Winnipeg, Man., will celebrate their third birthday on August 1, and to commemorate the event, and also to further increase their facilities for doing business, they have issued a splendid new catalogue of one hundred pages, illustrating their most active specialties and fixture lines.

The last three years have been "hard sledding" for many of the older established businesses, and the Mainer Electric Company feel that they must occupy a very necessary place in the electrical trade in the West, because in spite of the general decline they have been able to maintain their staff in a high state of efficiency, and can show that every year they have made additional progress. The building trade in the West has dropped considerably below the average of the previous years and it has thus become vitally important that the electrical supply houses develop those lines of electrical specialties which do not pertain to buildings. This new development has been carefully studied by the Mainer Company, and the results obtained have been a source of much gratification to the management. These special lines include Hughes electric ranges, Simplex domestic boiler heaters, Hurley washing machines and vacuum cleaners, Ohio mantel grates, Lincoln motor car battery chargers, Carlyle & Finch miniature electric plants, Universal heating and cooking utensils, White Cross vibrators, medical batteries, storage batteries, etc. Electric fixtures for house lighting has also become a very active department, and in their new catalogue, more than one hundred special new designs are shown. A number of popular sundries for the automobile and hardware trade are also illustrated.

The Mainer Electric Company is a product of Western Canada trade. Its reputation has been established by close and careful attention to the wants of the trade, and as the West comes back (and it is fast coming back), the company expect to further expand and continue to fill the very large space which they occupy in the electrical supply business. Mr. R. H. Mainer, the manager and vice-president of the company, has been identified with the electrical trade in Canada for many years. He states that he is quite satisfied with the progress made by his firm during the three years just passed, but he hopes that the next three years shall see the electrical field so developed that his firm will be forced to double the size of the present catalogue which has just been issued. His company are out for better business, cleaner competition and a reputation that will be a credit to Western Canada. They believe in the West, and have no pessimists in their organization, and they are egotists enough to believe that the West has faith in them. The company have a number of employees at the front, and are very proud of the fact.

Winnipeg Jovians Live Crowd

The sessional report of Secretary W. E. Skinner, of the Jovian League at Winnipeg shows several interesting items. This order of electrical men is a live one, and comprises almost every person connected with the electrical industry at Winnipeg. Mr. H. W. Billing, of the Union Electric Company, is President.

The following statistics cover the period from December 16th, 1914, to May 19th, 1915:—

Total attendance	586
Average per meeting	53.27
Number of luncheons held	11
Maximum attendance at luncheons	70
Minimum attendance at luncheons	34
Members on books	181
Number present at every luncheon	6
Messrs. W. G. Chase, W. B. Rickson, F. E. Filer, G. L. Guy, J. S. Henry, and W. H. Reynolds.	
Present at all but one luncheon	5
Messrs. R. H. Mainer, W. F. Mintz, J. H. Schumacher, B. S. Stewart, and W. E. Skinner.	
Members who were not in city during period covered	13
Number of visitors present	72
Number of visitors who became members	13
Number of new members during 1915	39

Will Erect $60,000 Addition

Contracts have been let and work started on a new three-storey concrete and steel addition to the plant of the Detroit Fuse & Manufacturing Company, 1400 Rivard Street, Detroit. The new building will have 35,000 sq. ft. of floor space which will give a total of 60,000 sq. ft. for the manufacture of "Square D" steel enclosed switches, "Square D" ironclad fused switches and "Square D" induction motor starters and "Arkless" enclosed fuses. This is the second addition made necessary by the company's increased business, since the first building was erected in 1909 at 1400 Rivard Street, the first addition being built in 1912. The new building will be built along the latest designs of factory construction, and will be equipped with the most modern machinery obtainable. President Bryson D. Horton in speaking of the rapid advance this company has made stated that in June, 1915, the largest month's business in the history of the company was placed.

The firm of Stuart & Davies, electrical contractors, Estevan, Sask., has been dissolved; the business diverts to the sole control of Mr. D. S. Stuart.

Withdrawing from Electric Field

One of the changes brought about by the present business depression is the retirement of the Canadian-British Engineering Company from the electrical supply field. This company, which was originally formed some years ago to market British-made machinery in Canada, purchased the Jas. Stuart Electric Company's stock at Winnipeg, and entered into the electrical supply business as well. After trying this for two years the company have now decided to drop the electrical supply end of their business, and devote all their energies to marketing the apparatus of the British companies they are agents for. Their electrical supply stock has been placed in the hands of the Western Trust Company as trustees to cover certain debentures. The trust company are placing the material on the market at, we are informed, less than jobbers cost prices.

J. D. Lachapelle & Company have removed to 317 St. James Street, Montreal. They represent the C and C Electric and Manufacturing Company, the U. S. Heating and Lighting Company, the MacLeod Company, and the Brown Instrument Company.

The Jovian League at Winnipeg are holding their annual picnic on July 31st, when they will visit Selkirk. The Winnipeg Electric Railway are providing special cars for the outing. All the arrangements have been completed for a royal good time.

Houston & Company, Limited, electrical wholesalers and sales agents, of Winnipeg, would be pleased to receive catalogues and discounts from manufacturing firms.

Trade Enquiries

Name and address of inquirer may be obtained on application to the Department of Trade and Commerce, Ottawa.

854. **Brass caps for electric lamps.**—A London firm is open to purchase large quantities of brass caps for electric lamps, and invites quotations from Canadian manufacturers.

861. **Electric lorries.**—A firm in Cape Town is prepared to place orders and accept agency for Western Cape Province for electric lorries carrying 750 to 1,000 pounds.

876. **Steel rails, railway ties, fishplates, etc.**—A Sheffield firm is open to buy steel rails for railroads and street car tracks and all kinds of railroad track equipment. They would also consider quotations on railway ties (sleepers) and keys.

Trade Publications

Bill-Board Illumination—Booklet B-3397, distributed by the Canadian General Electric Company, describing the illumination of bill-boards by Edison mazda lamps.

Lightning Arresters—Bulletin No. 41712, issued by the Supply Department of the Canadian General Electric Company, illustrating and describing lightning arresters for electric railway service.

Electric Arc Welding—Booklet issued by the Lincoln Electric Company, Cleveland, Ohio, describing with illustrations the underlying principles in the art of welding with the electric arc.

Centrifugal Blowers and Compressors for all pressures from 5 ins. of water, as in mechanical draft service, up to 125 lbs. per square inch, as for compressed air distribution in mines, machine shops, ship yards, etc., are described in a 64-page book issued by the De Laval Steam Turbine Company, of Trenton, N. J.

What is new in Electrical Apparatus

Cable Assemblies and Armored Cables

The Standard Underground Cable Company of Canada, Limited, Hamilton, Ont., are furnishing their automobile cables in assembled or "harness" form, as shown in the illustration, Fig. 1, complete with terminals and ready for installation. This method of selling cable was adopted by this company as a convenience for the buyer and it is said to possess the further advantage of economy and to make for neatness, since a good assembly makes the best looking installation on the finished car. The assemblies are made up to suit the dimensions of the cars on which they are to be installed and, since the necessary terminals are already attached, there is nothing to be done in installing the cable but make the connections.

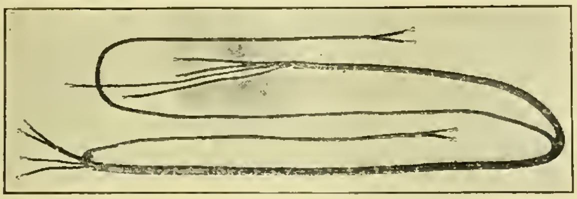


Fig. 1.

This company are also manufacturing a complete line of brass-wire armored ignition, lighting and starting cables for motor cars, motor boats and other motor-driven vehicles, Fig. 2. This armor is in the form of a strong "D" shaped ribbon wound closely over the cable, and is supplied in yellow, antique or nickel-plated finishes. Galvanized steel wire armor is occasionally used though somewhat less durable in construction. The insulation of these armored cables consists of high grade rubber, varnished cambric and waxed and varnished braids. Other types have plain rubber insulation without braided covering. The outer braid of the braided cables is saturated with multiple coats of special varnish which gives it durability even when not further protected by the brass-wire armor.

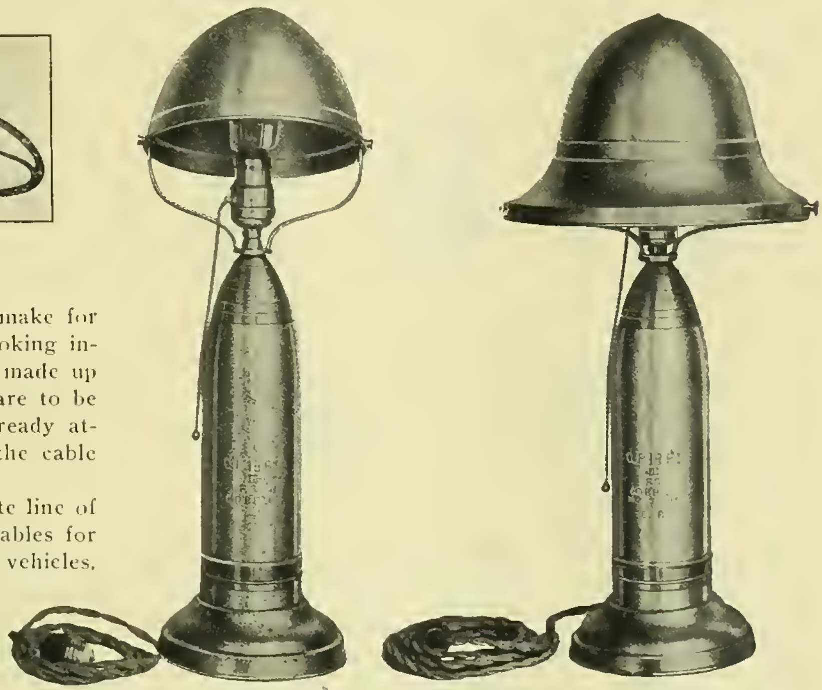
Fig. 2.

Outlet Box Receptacle

The figure herewith shows a new Hubbell outlet box receptacle, which provides a compact and simple conduit plug, incorporating the new Hubbell "T" slot feature, which makes it interchangeable with all their different types of caps. The receptacle is readily attached by clamping the outlet box cover between the upper and lower porcelain by means of a centre screw which threads through both.

Shrapnel Lamp with Adjustable Shade

The Colonial Fixtures, Limited, 424 Adelaide Street West, Toronto, are offering the trade something unique in the way of a genuine shrapnel portable lamp, made in two designs as illustrated. The body of the lamp is a shrapnel shell produced by Canadian shell makers for the present war, and every shell bears on the face the official manufacturer's and government mark. The main portion is in a polished steel, with the rim at the lower part of the body of copper, the remainder being made of solid brass, all well finished and lacquered. The shade is made of solid brass and is of military design. It is adjustable for better distribution and not stationary, as in the other types of shrapnel lamps on the market. The light stands 22 inches high, being 14½ inches from table to lower part of large shade and 16½ inches to lower part of small shade.



The Colonial Fixtures, Limited, manufacture a full line of lighting fixtures, specializing in a superior grade of their own special design in direct, semi-indirect and purely indirect fixtures.

Re Insulators on High Tension Electric Power Transmission Lines at Railway Crossings

The Board of Railway Commissioners are distributing the following circular among Canadian transmission companies:—

You are hereby directed to file with the Board on or before August 7th, 1915, reasons, if any, why the following order should not go into effect on that date:—

"All the insulators at wire crossings which are operated at a potential of 10,000 volts, or over, are to be renewed, or tested, and reported upon on or before November 1st, 1915, and until further notice at least once annually, thereafter.

"The following information will be required in the form of a report upon each crossing:—

"1. State the location of the crossing.

"2. State the operating voltages between:—(1) conductors; (2) conductors and ground.

"3. State the number of insulators (complete units).

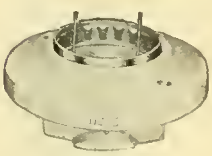
"4. When and where were the insulators last tested?

"5. To what tests were they subjected?"

New H. & H. Socket Base

A new socket base is offered by the H. T. Paiste Company which fits all the shells for their "Multipo" or "New Wrinkle" types of sockets. This base is designed to fit on the 10 ampere openings of round base pipe taplets, both those with a single opening and the gang types with two, three or four openings. To install these socket bases, remove the switch bar and ring which are used for fastening switches and other surface fittings. The base entirely covers

All these socket shells fit the pipe-taplet socket base.



Pipe-taplet socket base.

"Uno" Shadeholder with screw fastener.

the opening of the pipe taplets, making a neat looking fitting. No tap wires are required to fasten these socket bases to the main wires. The main wires are bared for half an inch and slipped under the heads of the binding screws. The key, keyless and pull socket shells can be used on the same base. The Hart & Hegeman Manufacturing Company are sole selling agents for Paiste material.

Meeting Demand for More Outlets

The continually increasing demand for electrically-operated devices causes many householders to regret that their rooms were not wired with more outlets. This demand can be conveniently met and the number of the outlets originally provided can be doubled by placing in each existing standard receptacle box a duplex receptacle, without adding to or changing in any way the original wiring or outlet box

Fig. 1.

Fig. 2.

installation. The Bryant type is illustrated herewith, Fig. 1. As will be noted this receptacle is the practical combination of two receptacle units on a single plate. This receptacle may also be used in floor outlet boxes.

The Bryant device illustrated in Fig. 2 is primarily designed to provide an attachment plug receptacle controlled by a switch, which can be installed complete in a regular 1-gang flush outlet box. If the combination is installed with the feed wires coming through the switch end it will control the device connected to the attachment plug, making it unnecessary to break the circuit by removing the plug. This permits a quick make and a quick break. The switch has an indicator which is especially valuable when it is used in connection with a device which of itself does not show whether current is being used.

Personals

Mr. A. G. Workman has been appointed chief dispatcher of the British Columbia Electric Railway Company, succeeding Mr. Connon.

Mr. W. G. Ferguson is acting manager of the Peterboro Radial Railway Company during the absence of Lieut. Munro at the battle front.

Mr. F. J. Gibbons has severed his connections with the Jefferson Glass Company, Limited, Toronto, Ont., and has left for his home in Cleveland, O.

Mr. J. J. Callaghan, superintendent of transportation of the Montreal and Southern Counties Railway, has been appointed operating manager of the London and Port Stanley Railway.

Col. D. R. Street, secretary-treasurer of the Ottawa Electric Company and president of the Canadian Electrical Association, has been given command of the 77th Regiment of Ottawa. We understand Col. Street will shortly leave for the battle front.

Mr. W. H. Munro, now in England, manager of the Peterboro Radial Railway Company, is an officer in the Mechanical Transport Branch of the C. A. S. C. and is detailed for special duty under General Carson in connection with the operation and maintenance of motor trucks.

Mr. A. B. Colville, vice-president and general counsel of the Electric Power Company, Limited, recently volunteered for active service and obtained a commission in the 39th battalion of the Canadian Expeditionary Force, Belleville. Mr. Colville is already on his way to the front.

Mr. Thos. Chater, for over a quarter of a century chief engineer of the Windsor City Electric Light Plant, died recently at his home in Walkerville. When the plant was recently taken over by the Hydro-electric Commission, Mr. Chater became chief engineer of the Windsor Water Commission, which position he held up to the time of his death.

Mr. Wm. B. Boyd, M.I.E.E., has been retained by the Sudbury and Copper Cliff Suburban Railway Company in the capacity of consultant. The line between Sudbury and Copper Cliff will be in operation by October 1st this year, and a further extension of twenty miles will be completed at an early date, extending from Sudbury to Coniston and from Copper Cliff to Creighton Mines.

Mr. J. H. Larmonth, who has been superintendent of the Edmonton Electric Railway at Edmonton, Alta., has tendered his resignation, to take effect the early part of August. A comparison of the statements of the Edmonton road for the first six months of 1914 and 1915 shows a substantial reduction in operating expenses this year, but unfortunately the smaller earnings as the result of unfavorable business conditions made a satisfactory showing impossible. With last year's business Mr. Larmonth would probably have been able to have shown a profit instead of a large deficit as formerly, and it is hoped that during his short term he has paved the way for getting the road on a paying basis when times become normal. Mr. Larmonth will likely return to Toronto.

Current News and Notes

Campbellford, Ont.

At a recent meeting in Campbellford of the Trent Valley section of the Hydro-electric Railway Association, a resolution was passed requesting the Hydro-electric Power Commission of Ontario to make a report on the feasibility of certain routes suggested.

Coaticook, P.Q.

New rates for light and power in Coaticook, P.Q., have been fixed as follows, beginning August 1st: domestic lighting, 6 cents per kw.h. with a minimum monthly charge of 75 cents for houses of seven rooms or less or 10 cents per room for houses having more than 7 rooms; commercial lighting, including stores, theatres, factories, hotels, and so on, 8 cents per kw.h. for the first 30 hours use of installed capacity; the balance at 5 cents with a minimum charge of $1.25 per month; cooking, 2 cents per kw.h., this service to be on special meter, for which the consumer pays 15 cents per month rental. A 10 per cent. discount is allowed on all accounts for prompt payment.

Exeter, Ont.

The ratepayers on July 16th endorsed the hydro by-law authorizing expenditure of $20,000 on a distribution system, by a vote of 247 to 7.

Halifax, N. S.

The Halifax Power Company, who claim to own the nearest and best water fall for the development of hydro-electric power for the city of Halifax, offer to sell the city one-half of their rights at cost price. This company has the right to supply light and power within the city of Halifax.

London, Ont.

The newly electrified line from London to Port Stanley was formally opened for service on July 22nd, when some 500 delegates enjoyed a special trip over this 23-mile line. In honor of the occasion Lady Beck was presented with a handsome electric automobile. It was stated that during the first three weeks of July this line carried 42,000 passengers to Port Stanley.

Morse, Sask.

The Morse electric light plant has been disposed of by Mr. D. A. Gooch to Mr. E. Lapoujade.

Montreal, Que.

The Montreal council have appointed a special committee to confer with the Bell Telephone Company on the subject of rates in certain districts of the city, it being contended that such rates are exorbitant. In the event of the negotiations being unfavorable, the committee are asked to consider applying to the Railway Commission, and also if necessary study the question of a municipal telephone service, using the city conduits for this purpose.

The Electrical Illumination Company of Canada, Limited, has registered in Montreal, P. Q.

The Engineers' Club, Montreal, several members of

which are identified with electrical interests, have contributed a machine gun to the 60th Battalion, which has just been raised in Montreal. The money was contributed largely through the exertions of Mr. W. B. Baxter.

Both gross and net earnings of the Montreal Light, Heat and Power Company continue to show gains. For the first two months of the fiscal year, May and June, the gross earnings totalled $1,034,626 against $993,262 in 1914; net earnings from operation $576,702, against $534,133; and surplus available for dividends $495,314, against $464,495. In June the gross earnings increased $16,135 and the net $19,127.

Orangeville, Ont.

The town council of Orangeville is considering a report which has been made by the Hydro-electric Power Commission of Ontario on the price that they would be justified in paying for the two local electric lighting plants. It is estimated that an expenditure of $40,000 would purchase these plants and also reconstruct the distribution system.

Peterborough, Ont.

A hydro by-law authorizing the council to raise $50,000 for extension work carried, in Peterborough, by a considerable majority.

Petrolia, Ont.

A by-law was recently carried authorizing bond issue of $35,000 to cover the expenses of an electrical distributing plant.

Port Rowan, Ont.

The town council have decided to obtain estimates on the cost of installing an electric light distributing system in the town of Port Rowan.

Quebec, Que.

A somewhat belated report of the operations of the Quebec Railway, Light, Heat and Power Company for the year 1913-14 has now been published, which shows a slight increase in earnings. These amount to .8 of 1 per cent. of the common stock, as against .7 the previous year.

Regina, Sask.

The following telephone companies have been given authority to borrow various sums of money for extensions to their systems: Talmage Rural Telephone Company, South Tyvan Rural Telephone Company, West Graytown Rural Telephone Company, North Churchbridge Rural Telephone Company, Kronau Rural Telephone Company, Colfax Rural Telephone Company, Sunshine Rural Telephone Company, Silverwood Rural Telephone Company, Kilmory Rural Telephone Company, Crescent Rural Telephone Company, Gartmore-Zorra Rural Telephone Company, Great Deer Rural Telephone Company, Unity Rural Telephone Company, South Radisson Rural Telephone Company, Third Meridian Rural Telephone Company.

The members of the Regina Engineering Society recently made an inspection of the municipal power house, superintendent Bull acting as host.

Saskatoon, Sask.

The power consumption of the city of Saskatoon for the month of June, according to a recent report by the Electrical Department, was 608,470 kw.h. This is a decrease of 1.62 per cent. as compared with the previous month, and only 10.2 per cent. less than the same month a year ago—a remarkably good showing considering the conditions.

St. Mary's, Ont.

The following rates have been submitted by the Hydro-electric Power Commission of Ontario to the villages to be supplied with current by the line running out from St. Mary's. Farmers will also be supplied along the way: Exeter, 200 h.p., $47.30; Creighton Corners, 50 h.p., $35.88; Granton, 100 h.p., $44.15; Kirkton & Woodham, 50 h.p., $43.24; Crediton, 75 h.p., $52.12; Centralia, 75 h.p., $47.37.

Sault Ste. Marie, Ont.

A notice appears in the Ontario Gazette of an order directing the dissolution of the Tagoma Water and Light Company, the same to take effect the 4th day of August.

Sudbury, Ont.

Work on the Sudbury and Copper Cliff Suburban Electric Railway has been commenced. A number of orders have already been placed for equipment, and it is stated that the road will be operated during the coming autumn.

The Pas, Man.

The municipality of the town of The Pas will expend $50,000 on extensions to their generating and distributing electric system.

Toronto, Ont.

The statement was recently made by Sir Adam Beck that "within the course of the next few weeks we will submit to the Ontario Government plans providing for power development at Niagara Falls and from the spillways of the new Welland Canal, of 250,000 h.p., and an immediate development of 100,000 h.p." It was also stated that the plans will be capable of extension to develop ultimately 600,000 h.p.

Victoria, B. C.

The city council of the city of Victoria, B. C., recently visited the Jordan River generating plant of the British Columbia Electric Railway Company and were shown around by Mr. A. T. Goward, local manager, and Mr. G. M. Tripp, mechanical superintendent.

Welland, Ont.

The town council of Welland recently awarded the contract for the supply of electric energy up to 5,000 h.p. to the Hydro-electric Power Commission of Ontario at $11.50 per h.p. year. It is said that the quotation of the Ontario Power Company was $14.50, and of the Toronto Power Company, $15.00.

Heating Hub of Turbine Spider Saves Four Days' Time in Mounting

By Harold F. Johnston

Instead of taking four days to put a 27-ton spider on a 11-in. shaft with a 100-ton hydraulic press an erection superintendent in Alberta recently succeeded in making a satisfactory mounting in less than four hours by heating the hub of the spider enough to expand it a little. The cost of mounting the spider in the press would have been $60, while the actual operation performed cost only $5. As time was a most important factor in the contract, however, the saving of over three and one-half days was of much more value that the small saving of labor.

The spider carried the rotor and field coils. It had to be keyed to a 15-in. vertical shaft directly connected through a coupling to the turbine shaft. The shaft was first mounted, and the coupling bolted up. The spider, on which the field coils had already been mounted, was blocked up about 9 inches off the powerhouse floor. A ring of sand was then built around the outside of the hub, forming a pit under the hub in which a fire of dry pine chips was built. The top of the hub was covered with steel plates to help confine the heat. One man kept tending the fire, keeping it evenly hot all around the hub for three and one-half hours. The spider was then raised by the crane and easily fitted over the shaft. It was quickly turned to the proper position, the key driven home, and the mounting completed. The job proved entirely satisfactory, and the 100-ton press sent out by the contractor to comply with the specifications was returned unused.

The installation was made by the General Electric Company of Sweden, at the plant of the Calgary Power Company, at Seebe, Alta. Two 12,000-volt, 4200-kv.a. generators were erected.

WANTED

Lathes (new), minimum length of bench, 1 metre; minimum height of points, 250 millimetres.

Hydraulic presses (new), 800 millimetres stroke, 400 tons pressure, 150 kilogrammes water pressure per square centimetre; as well as all kinds of

Machine tools, which can be delivered on short notice.

Send descriptions, catalogues, blue-prints, prices and shipping details, etc.

Telegraph: Etablissements Astra, 182 rue Lafayette, Paris, France, if you have any of the above to dispose of.

Situation Vacant

Situation for experienced electrician as foreman and assistant superintendent of light, power, telephone, and railway lines, construction, installation, maintenance in each department. State experience, reference salary expected, and when services available.

Secretary, Public Utilities Commission,

15 City of Port Arthur, Ont.

Electrical News
Generation Transmission and Application of Electricity

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ADVERTISEMENTS
Orders for advertising should reach the office of publication not later than the 5th and 20th of the month. Changes in advertisements will be made whenever desired, without cost to the advertiser.

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The "Electrical News" will be mailed to subscribers in Canada and Great Britain, post free, for $2.00 per annum. United States and foreign, $2.50. Remit by currency, registered letter, or postal order payable to Hugh C. MacLean, Limited.
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Electric Cooking a "Science"

The statement that electric cooking is a science does not insinuate that cooking with any other source of heat whatever is not a highly scientific operation requiring patience and skill above the ordinary. Cooking with electricity, however, undoubtedly adds to the possibilities for skillful manipulation, and savors more of the field of laboratory research work than of domestic drudgery. This of itself is an outstanding argument in its favor owing to the fact that many of our home keepers are university graduates or otherwise thoroughly trained women to whom the management of a household necessarily appeals in proportion as it is farther removed from the plane of mechanical dish-washery to that of the intellectual study of problems that require the exercise of all their training and skill.

These are pre-eminently days when efficiency is one of the main goals for which we strive whether in the office or the home—to do more in the same time, do it better and do it at less cost. This no doubt is the spirit in which our domestic science schools are being established (and attended) all over the empire. This striving for efficiency in household appliances has been a big factor in making electricity the important consideration it is in our homes to-day. But the same care and study which has been exercised in manufacture has not yet been expended in the direction of mechanical operation and here is a problem which now confronts the electrical industry. Broadly speaking the next step must be made by the housewife herself. Without her co-operation the highest efficiency in electrical equipment in the home cannot be obtained.

That this work is of a highly scientific nature and as such worthy of our most active minds, is shown by the unexpected results that are being obtained by manufacturers and others in comparing methods of cooking and baking under varying conditions of temperature, equipment, etc. For example, so apparently immaterial an item as to whether it is best to sear a roast of beef in the electric oven or in a separate pot resolves itself, in skilled hands, into the saving of a kilowatt hour of electric energy. Opening the oven door at three minute intervals keeps the temperature of the oven more than 30 per cent. lower than if the door were kept closed continuously, and so on. A result also that will occasion some surprise is that a roast is actually cooked in less time at a temperature of 160 degrees than at a temperature of 180 degrees.

We reproduce on other pages in this issue a very comprehensive paper on the scientific possibilities of electric cooking. It clearly indicates that the main work of a household can no longer be delegated successfully to the weak-minded individual whose highest ambition is three afternoons a week and a "steady." The kitchen is taking on the prominence of a factory, second only in actual importance from an economic point of view, to the work of the man of the house. As such it offers a field of operation for our clever Canadian women which they will be quick to take advantage of and which, it goes without saying, they must soon place under control.

A Rapid Transmission-Line Chart

Transmission-line charts or calculating devices have proved to be of considerable value to electrical engineers. They not only save time and labor in the solution of alternating-current line problems, but they constitute a compact, portable arrangement of a large amount of line data.

A line chart is useful for several different problems connected with various classes of work. It shows the voltage drop when the line and load are specified; it shows the permissible load for a given line, with given voltage loss; and it indicates the required size of conductor when the load and drop are given. Such problems are encountered not only by the designers of transmission-lines, but also by those engaged in the operation or construction of low voltage distribution systems. The chart shows the effect on the voltage regulation of installing a large induction motor, or the effect of a synchronous condenser operated at either leading or lagging power-factor. In the accompanying figure there is illustrated a chart which has recently been published* and which is useful in solving the above problems.

Line capacitance, which causes what is commonly known as the charging current of a line, has an important effect on the accuracy of transmission-line calculations. Practically all transmission-line charts or calculators neglect entirely the effect of capacitance. Attempts to make very accurate allowance for capacitance would probably destroy the appropriateness of the name "labor-saving devices." However, account should be taken of line capacitance for it changes the voltage drop along a 100-mile, 60-cycle line from what would otherwise be 10 per cent. to about 7.8 per cent., and it changes the voltage drop of a 35-mile line by about 0.26 per cent. It is plainly idle to state that the line drop is calculated correctly within 1/5 of one per cent. when an error ten times as great is made by neglecting capacitance. The effect of capacitance on the regulation of the voltage from no load to full load is less than the effect on the voltage drop from the generator end to the receiver end of the line, but it may be more than 1/5 of one per cent. for lines up to 100 miles long.

In Fig. 1 there is shown an extremely simple method of making allowance for capacitance, which is at the same time as accurate as required for this class of work. The correc-

CHART FOR VOLTAGE DROP OF A. C. ELECTRIC POWER LINES

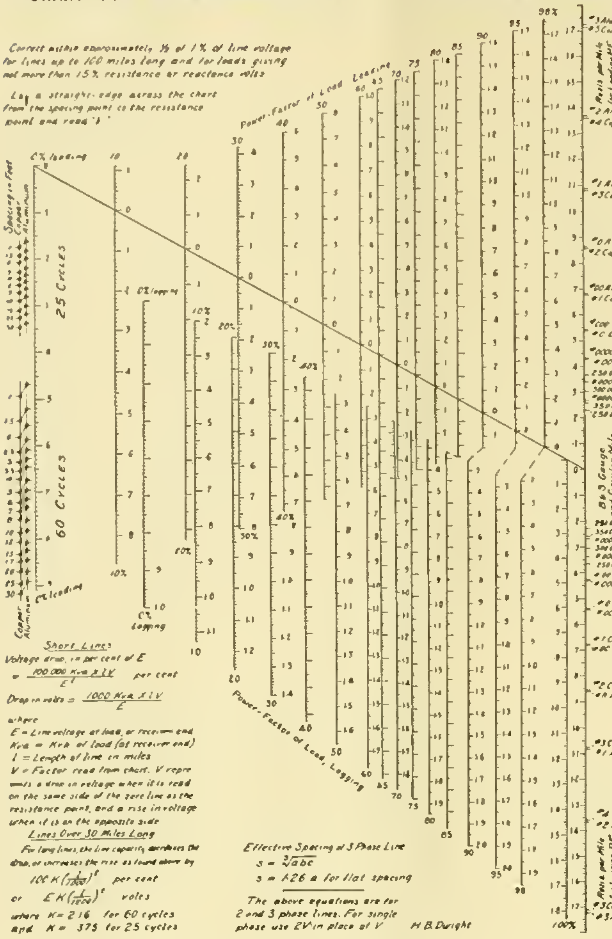


Fig. 1.—Reduced facsimile, the "Rap'd" transmission-line chart.

tion in voltage is seen to be proportional to a constant "K," which is equal to 2.16 for 60 cycles and to 0.375 for 25 cycles.

The application of the chart to a typical problem may be illustrated by making use of Fig. 1 to check the voltage drop in the following case:—

Length of line—100 miles.

Conductor No. 0000 B & S Copper.

Spacing, 10 feet, triangular.

Load, measured at the receiver end of the line, 20,000 kv.a., 110,000 volts, 80 per cent. power-factor lagging, 3 phase, 60 cycles.

Lay a rule across Fig. 1 from the 10 ft. spacing point for copper conductor, 60 cycles, to the point on the lower resistance scale for No. 0000 copper. It will be seen to give the reading 0.70 on the 80 per cent. power-factor line. Then the per cent. line drop

$$= \frac{100,000 \times 20,000 \times 100 \times 0.70}{110,000 \times 110,000} - 100 \times \frac{2.16}{100}$$

$$= 11.6 - 2.16.$$

$$= 9.4 \text{ per cent. drop approximately.}$$

The calculated value of the line drop according to the hyperbolic theory is 9.34 per cent., showing an error due to the chart of 0.1 per cent.

Other examples are tabulated, showing the percentage error of the chart for some usual problems. (See Table 1.)

Underground Conduit Discussion

Additional evidence for and against the plans of the Montreal Electrical Commission for underground conduits in the St. Lawrence Boulevard district was given before the Quebec Public Utilities Commission. The chief opposition came from the Montreal Public Service Corporation, the objection being to placing the wires for the telegraph, fire alarm and police call signals in the same conduits as those of the power and light companies. It was alleged that this would be a source of trouble, and a separate system of conduits was advocated. Messrs. L. H. Charest, superintendent of the Civic Fire Alarm Department, M. Tremblay, head of the Fire Department, and Mr. James Camp, assistant manager of the Canadian Pacific Telegraph, gave evidence in favor of separate conduits, while Mr. R. M. Wilson, chief electrical engineer of the Montreal Light, Heat and Power Company, and Mr. R. H. Balfour, chief engineer of the Electrical Commission, were witnesses in favor of the plans of the Commission.

The contention of those opposing the plans was that it was dangerous to place high and low tension cables in the same conduits, Mr. Camp mentioning that in Hamilton they had adopted the system of separate manholes. There the wires run through the same trench, but the two classes of cable are separated by a concrete partition three inches thick. He believed the chief danger existed in the manholes where the wires run side by side.

On the other hand, Mr. R. M. Wilson testified that his experience of underground cables in Montreal led to the conclusion that the plans are satisfactory, provided that proper precautions are taken, although he suggested a few minor changes. In Montreal high and low tension wires run on the same poles in many cases; the two classes of cables had also been in use in the same conduits for many years, and he knew of no such trouble as was anticipated by witnesses against the plans.

Mr. R. H. Balfour spoke of investigating the system in Baltimore, laid out on similar lines to the one in Montreal.

TABLE I.

Length of Line in Miles	Conductor (Stranded) B. & S. Gauge	Spacing in feet	Voltage at Receiver	Phases	Cycles	Kva. at Receiver.	Per cent P. F. at Receiver	Per cent Line Drop by Chart, including correction for capacitance	Per cent Line Drop calculated, allowing for capacitance	Error, in per cent of line voltage.
3	No. 0 Copper	1½	2,200	3	25	400	70 Lagging	13.6	13.87	— 0.3
8	No. 2 Copper	2	11,000	2	25	2,500	100	14.4	14.21	+ 0.2
15	No. 0 Copper	3	11,000	1	60	300	50 Lagging	6.3	6.40	— 0.1
60	250,000 C.M. Alum.	12	100,000	3	60	30,000	0 Lagging	13.8	13.67	+ 0.2
75	No. 00 Alum.	8 ft. flat	88,000	3	25	10,000	85 Lagging	7.1	7.13	— 0.1
80	No. 00 Alum.	10	100,000	3	25	15,000	95 Lagging	8.8	8.81	Small
100	250,000 C.M. Copper	15	120,000	3	60	25,000	80 Leading	6.7 (rise)	6.45	— 0.25
100	No. 3 Copper	8	66,000	3	60	3,000	90 Lagging	7.1	7.08	Small

The system of a common conduit for high and low tension wires was in use for over 200 miles in Baltimore and his enquiries showed that there was practically no trouble with other wires in the case of a blow-out by a high tension wire. He produced letters and cables from engineers of power and telegraph companies in the United States, where the joint system is in use, confirming his view. In cross-examination, however, he admitted having received communications from other cities unfavorable to his contention.

The Commissioners again adjourned the inquiry, for the purpose of ascertaining the comparative cost of the two systems.

Cost of Transmission Lines

At the recent convention of the N. E. L. A., Mr. J. C. Martin contributed a paper containing the following data with reference to the cost of two 6600 volt lines, respectively 17.5 and 14.5 miles in length. It will be noticed that telephone and railway crossings constitute a considerable additional item in the cost figures; on the longer line there are 32 telephone and railway crossings, and on the shorter line, 9. It will be noted that both these lines show a loss in operation, but it is understood that they were built with an eye to the future, when the business developed by their presence shall have taken on a much greater volume. The figures are interesting as being typical of what may be expected of many of our branch lines now being run in Canadian rural districts.

Table I.—Cost Data for 17.5 Mile, 6600-Volt Line—Thirty-Two Crossings

Actual cost of line	$26,463.00
Additional cost for crossing construction, 1911 N.E.L.A. specifications	2,553.28
Total	$29,016.28
Actual annual revenue	$4,350.35
Operation and fixed charges:	
(a) Line as built:	
Depreciation (average 5.2 per cent.)	$1,378.15
Operating	948.86
Maintenance	194.94
Taxes	105.63
Interest, 8 per cent.	2,117.04
Total operating cost for year	$4,744.62
Loss per year	$394.27
Loss in per cent. of actual cost of line	1.49
Loss in per cent. of annual revenue	9.10
(b) With crossing construction included:	
Depreciation	$1,531.35
Operating	948.86
Maintenance	194.94
Taxes	105.63
Interest, 8 per cent.	2,321.30
Total operating cost for year	$5,102.08
Loss per year	$751.73
Loss in per cent. of actual cost of line, plus crossing construction costs	2.6
Loss in per cent. of annual revenue	17.3
Number of crossings	32
Total estimated cost of crossing construction	$2,533.28
Average cost per crossing	$79.79

Table II.—Cost Data for 14.5-Mile, 6600-Volt Line—Nine Crossings

Actual cost of line	$18,829.00
Additional cost for crossing construction, 1911 N.E.L.A. specifications	886.86
Total	$19,715.86
Actual annual revenue	$3,727.45
Operation and fixed charges:	
(a) Line as built:	
Depreciation (average 5.35 per cent.)	$1,006.31
Operating	1,006.95
Maintenance	245.20
Taxes	90.77
Interest	1,506.32
Total operating cost per year	$3,855.55
Loss per year	$128.10
Loss in per cent. of actual cost of line	0.68
Loss in per cent. of annual revenue	3.44
(b) With crossing construction included:	
Depreciation	$1,069.48
Operating	1,066.95
Maintenance	245.20
Taxes	90.77
Interest	1,577.27
Total operating cost	$4,049.67
Loss per year	$322.22
Loss in per cent. of actual cost of line, plus crossing construction costs	1.63
Loss in per cent. of annual revenue	8.65
Number of crossings	9
Total estimated cost of crossing construction	$886.86
Average cost per crossing	$98.54

Parcel Post Service by Electric Vehicle

The Electric Vehicle Association of America have just published some interesting information regarding the use of electrics in parcel post delivery and mail collection at a number of different points in the United States. The first case refers to a demonstration in Denver, Col., where a total of 46.3 miles was covered in 7 hours and 12 minutes, and an actual running time of 6 hours and 23 minutes. One hundred and fifty packages were delivered and 143 stops made, so that the time consumed in driving to and making the delivery at each stop was 2 minutes 40.7 seconds, and the average time of driving to and delivering each package 2 minutes 33.2 seconds. The average number of stops per mile was 3.06. This was a 1,000 pound truck with a capacity of 18.14 kw.h. The energy actually consumed was 14.1 kw.h., which at 3.6 cents, the local rate, works out to 50.7 cents or 1.0 cents per mile, or .35 cents per stop, or .33 cents per package.

Another demonstration was made of collecting mail, using the same truck, and in this case 26.5 miles were covered in 4 hours and 28 minutes, in which time 147 collections were made with 137 stops. The average time consumed in driving to and making the stops was 1 minute 57.3 seconds, and the average time in driving to and making each collection was 1 minute, 49.4 seconds. The average number of stops per mile was 5.17. The cost of current in this case worked out to 44.6 cents, being 12.39 kw.h. at 3.6 cents, making the cost per mile 1.7 cents, the cost per stop .32 cents and the cost per collection .30 cents.

The report further adds that for postal service in the United States it seems evident that motor vehicles must necessarily supersede the older horse-vehicle equipment, and during the past five or six years a number of motor vehicles have been employed. Conspicuous among these has been the satisfactory performance of 20 to 30 electrics in service in New York City during the four-year contract period closed last year.

Twelve of these electric trucks are now in service, making deliveries from 19 postal sub-stations in New York to addresses of large and heavy packages sent through the parcel post. This service was begun with the inauguration of the parcel post, seven vehicles having been used during the first month, fifteen for a subsequent period, and later, due to changes in the system, this number has been reduced to the twelve mentioned.

303 deliveries per day per vehicle

During one winter month in 27 days these machines travelled 7,111 miles, and delivered 98,243 parcels. At this rate the parcel-post truck fleet covered an average distance of 263 miles per day, or 22 miles per individual vehicle. These vehicles, it should be noted, have, however, capacities of 45 miles per charge. Deliveries were made at the rate

of 3,628 parcels per day, or about 303 per day per vehicle. The average distance travelled per package delivered was 0.0724 miles, or 362 feet. At the rental paid by the Government for this delivery service, the average cost per parcel was 3.3 cent, not including, however, the salary of the carrier, who accompanied the truck on its round, and made the actual deliveries to addresses.

In addition to the electric trucks just mentioned a number of large machines are used for mail haulage between the New York City depots and postal stations. Some of these cars have been in service five or six years, having been used 24 hours per day in the year during much of this period. Such mail service, according to those familiar with its requirements, is one of the most exacting to which motor trucks can be applied.

Cost of day's run $5.60

The three electric delivery wagons used by the Indianapolis Post Office have proven very reliable and it is declared have never failed to perform any service that they have been called upon to do. In point of speed and mileage they have been found ample for parcel delivery, for the requirements in this direction are all within the range of their capacity. In a seven-hour working day these electric wagons averaged 271.5 parcels in 189 stops over a distance of 18.75 miles. The cost of the day's run, not including the wages of the carrier, was $5.60. The unit costs were as follows:

Stops per mile	6.02	
Cost per stop	3.25	cents
Cost per parcel	2.06	cents
Cost per parcel mile	0.0011	cents

Last year the Parcel Post Delivery Committee of the Electric Vehicle Association of America, having the cooperation of the N. E. L. A., conducted a very extensive campaign with all the government officials at Washington, the postmasters generally throughout the country, central stations and electric vehicle manufacturers, with the object of inducing the Post Office Department authorities to recognize the value which had been credited by the most conservative business organizations throughout the country to the electric vehicle as a transportation utility in city services.

250 Electrics average 30 m. per day

The comprehensive delivery system of Marshall, Field & Company, Chicago, is one of the best examples of the success of the electric in a house to house delivery. It should be borne in mind that the parcels post delivery is so similar to any house to house delivery such as department stores use, that their successful operation by such organizations as Marshall, Field & Company should have considerable weight with the post office authorities. There are at present 230 electrics used by Marshall, Field & Company, which have an average mileage of 28 to 30 miles per day, some of the lighter vehicles travelling as far as 40 miles per day. To do the same work from 850 to 900 horses would be required. The following is a list of some of the largest electric vehicle "fleets" in three other cities. Gasoline trucks are used for long hauls:

Ward Baking Co. uses 610 electrics, 42 gasoline trucks.
Adams Express Co., 326 electrics, 160 gasoline trucks.
American Express Co., 220 electrics, 154 gasoline trucks.
Jacob Rupert, 145 electrics, 37 gasoline trucks.
Geo. Ehret Brewery, 136 electrics.
Commonwealth Edison, 114 electrics, 2 gasoline trucks.
N. E. Edison, 130 electrics, 3 gasoline trucks.
Gimble Bros., 110 electrics, 97 gasoline trucks.
Carson Pirie & Scott, 67 electrics, 21 gasoline trucks.

The firm of Chas. A. Stevens Bros. advise as follows,—"We were the first company in Chicago to install an electric for delivery purposes. That was in 1897. We find the electric very well adapted to our work. Contrary to usual practice this company has its electrics in use in suburban delivery, and find that they are all that can be desired."

Such statements from conservative houses mean a great deal, and the above list of installations bears witness further to the possibilities of the economy of the electric when applied to the functions desired in the haulage and delivery of parcel post material. The electric vehicle is particularly well suited for house to house delivery or other transportation work requiring frequent starting and stopping due to the extreme simplicity of operation and absence of all gear shifting.

That Peak Load Problem

We've rustled for power contracts and landed a lot as well, well,
We've hunted the country over for fancy outfits to sell,
We've peddled electric irons, we've boosted electric pots,
And gathered up fans and sold 'em in regular carload lots,
We've hinted and preached and threatened and advertised year on year
And talked to the folks like Uncles and written 'em plain and clear,
But in spite of our ceaseless efforts, our labors almost sublime
Full half of our power units are idle most of the time.

And that's the fault of peak load
(It never is a weak load)
Which jumps upon the backs of us at certain times of day
A bold and not a meek load,
A make-you-swear-a-streak load,
Oh, if it weren't for peak load our labor would be play.

The sun goes down in the western sky and the stars come into sight,
And the homes of the busy city are drawing on us for light,
The theatres glow in glory, the signs and the street lights glare,
And here at the central station we've worry enough to spare,
For the straining boilers trouble, the laboring engines throb

And we start up the whole equipment to handle the heavy job,
It's trouble enough on week days to manage the problem well
And then when Saturday Night comes round—say SATURDAY night is Hell!

And so we cuss the peak load
The big load, the freak load,
Which jumps upon the backs of us at certain times of day,
A strong and not a weak load
A make-you-swear-a-streak load,
Oh, if it weren't for peak load our labor would be play.

If only the load were steady each hour of the twenty-four
We wouldn't be fretting and fuming and figuring any more
On boosting the "off hour" business by every kind of scheme;
But the peak load still is with us and life is no idle dream.
For all of the new inventions we've brought to the public's view
Electric curling irons and vacuum cleaners, too,
For all our advertising, our urging in prose and rhyme,
Full half of our power units are idle most of the time.

And that's the fault of peak load
(It never is a weak load)
Which jumps upon the backs of us at certain times of day,
A not at all unique load
Yet, in a way, a freak load
Oh, if it weren't for peak load our labor would be play.

By Berton Braley, in Power.

The "Science" of Electric Cooking

Marked economies may be effected in kitchen operations by a study of the different variable factors in the use of the electric range. The home now affords as great scope for system and capable management as the factory or the office. The "electric" changes housework from a drudgery to a profession.*

As the use of electricity has been extended to new fields of endeavor it has been the province of the electrical engineer to invade these fields with the purpose of studying the processes and developing better apparatus. The first step has usually been to replace with electricity the former source of energy, keeping much of the old type of apparatus. After a detailed study has been made of the requirements, however, new apparatus is usually developed which incorporates to a greater extent the advantages of the new source of energy.

The first electric ovens were constructed by replacing the burners of a gas oven with electric heating coils. Since the first electric ovens were made there has been considerable improvement in the design and construction of the electric oven. This development has resulted in a more reliable piece of apparatus and a lower operating cost, but practically no study has been made of the proper conditions for cooking food which make for greater convenience and economy of operation. The present stage in the development of electric cooking might be compared to the conditions which would have obtained, if all the progress in electric lighting had resulted only in increasing the life and efficiency of the electric light without adding in any way to our knowledge of the proper arrangement and character of lights to use under various conditions. Before the advent of the electric light very little was known of the principles of illumination so as to obtain the greatest efficiency of operation. Before the introduction of electric cooking and even to-day very little is known of the proper conditions of time and temperature to use in cooking various articles of food so as to secure the greatest efficiency. With cheap fuels and inefficient stoves it makes little difference whether a particular article of food is cooked for half an hour at 200 deg. cent. or for one hour at 150 deg. cent. as long as the quality is satisfactory. With electric cooking, however, the temperature at which food is cooked makes a considerable difference in the cost of the cooking.

It is the purpose of this article to study the operation and design of electric ovens, with the view of determining some of the factors which will increase the popularity and economy of electric cooking.

Apparatus Used

In order to determine the losses of energy in electric cooking and the best methods of preparing various articles of food in electric ovens, tests were made on three commercial ovens and an experimental oven. Each commercial oven was selected as representing a general type of electric oven in use for domestic cooking.

Oven No. 1 was a large range suitable for a good size family. The inside dimensions of the oven were 12 in. by 12 in. by 18 in. Two heating units are used, one in the top and one in the bottom of the oven. Each unit consists of two heating coils controlled from a snap switch on the front of the oven so as to consume 220, 440, or 880 watts. From one to two inches of mineral wool is used as heat insulation. The outside surface of the oven is blued steel with nickeled legs and trimmings. The oven door is 12 by 18 inches and 1.5 in. thick. It fits tightly and clamps securely in place when shut. Three heating units are also placed on top of the stove for the cooking which is not done in the oven.

Oven No. 2 was a small, well insulated oven suitable for a small or medium size family. The inside dimensions of the oven are 9.5 in. wide, 10 in. deep, and 12 in. high. The inside finish is seamless drawn aluminum and the outside is blued steel with nickeled trimmings. Two and one-half inches of mineral wool is used for heat insulation. An iron-clad heating element is placed in the bottom of the oven. The heating element consumes 500 watts when connected to a 110 volt circuit. The heat cannot be turned partly off as there is only one heating element. There is no heating unit in the top of the oven. Underneath the oven is an automatic temperature control which may be set at various values by means of a dial. The dial is graduated in arbitrary numbers from one to eleven. When the handle of the dial is set at a given number a thermostat will open the circuit of the heating element as soon as the inside of the oven has reached

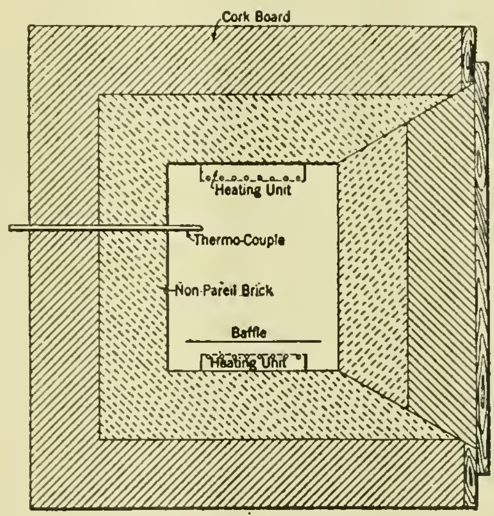


Fig 1. Oven No. 4, specially insulated.

a certain temperature. As the oven cools the thermostat must be reset by hand by pushing the handle of the dial.

Oven No. 3 was one of the well-known makes of fireless cookers with a heating element placed underneath the inner lining. The inside dimensions are 10.5 in. deep and 12.5 in. diameter. The inside lining is seamless drawn aluminium and the outside finish is varnished oak. The sides and bottom are insulated with powdered kieselguhr while the cover is insulated with granulated cork. The oven uses 500 watts at 110 volts. There is no method of turning the oven partly off.

Oven No. 4 was constructed by the author so as to obtain data on the characteristics of an especially well insulated oven. The inside dimensions were the same as oven No. 2. A 220, 440, 880-watt heating unit was placed in the bottom of the oven and a 440-watt heating unit was placed in the top. Sheet iron was used for the inside lining of the oven. A four inch layer of a commercial brand of diatominous insulating brick was used for insulation. Later four inches of cork board was added, see Fig. 1. This was put

* P. W. Gumaer before the A. I. E. E.

on with cement and no outside covering was used except on the front and the door which were covered with wood.

The temperature of the ovens was measured by means of copper-constantan thermo-couples. An indicator galvanometer and a recording galvanometer were used to determine the e.m.f. of the thermo-couples. The recording galvanometer traced a curve by intermittent contact on a circular smoked chart. Both the indicating and the recording galvanometer were calibrated for the copper-constantan thermo-couples by means of mercury thermometers certified by the

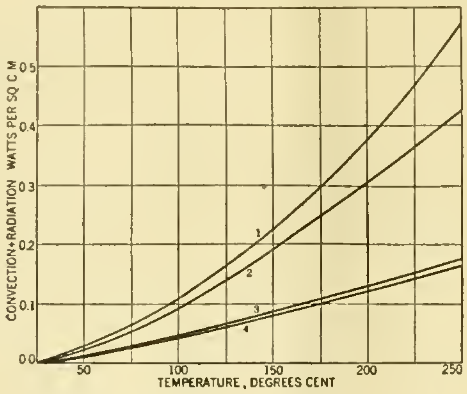


Fig. 2—Total losses from heated surfaces in air. Convection loss is for vertical surfaces
1. Black body. 3. Pure silver.
2. Oxidized copper. 4. Convection only.

Bureau of Standards. The calibration was made by slowly heating the thermo-couple and thermometer in an oil bath.

In the oven the wires of the thermo-couple were enclosed in a glass tube and separated by mica. Outside the oven they were enclosed in rubber tubing. The cold junction was kept at zero degrees cent. by immersion in ice water. Two thermo-couples were used in series so that a larger deflection was obtained and as the hot junctions were in different parts of the oven the temperature recorded was a mean of the two values.

In oven No. 1 an extra thermo-couple was inserted for measuring the internal temperature of food. The wires entered the oven through two glass bushings and were left bare except for a three-inch glass tube at the end which was inserted in the food.

The Purpose of Cooking

Before discussing the problems which must be solved before an ideal electric cooking device can be perfected, a word about the purpose of cooking foods will not be out of place. Briefly stated, the objects of cooking food are: (1) to render it more digestible so that the digestive organs can more easily digest and absorb the nutrient parts, (2) to make the food more appetizing by improving its appearance and by developing in it new flavors, (3) to sterilize it so that it will keep longer. The relative importance of each purpose depends upon the article of food which is to be cooked. For example, in the cooking of animal foods the improvement of the flavor and the appearance is the most important. The cooking of these foods, which are rich in protein, actually decreases their digestibility. This is true at least of the chemical processes of digestion, but the increased attractiveness of well cooked meat may render it indirectly more digestible by causing a greater flow of the digestive juices.

The effect of heat on the protein of foods is to coagulate it. This change occurs at the comparatively low temperature of 75 deg. cent. If the temperature is increased much above this point the protein tends to shrink and harden, and the digestibility of the food is greatly lessened thereby.

The effect of heat on the starch of foods is to make it more digestible. In many vegetables and unground cereals the starch grains are enclosed in woody fibrous, or cellulose walls which are but slightly affected by the digestive juices. The effect of cooking by the application of moist heat is to cause the starch grains to swell and finally to rupture the cellulose walls. The starch is then said to be gelatinized. This process occurs at temperatures much below the boiling point of water. The investigations of the U. S. Department of Agriculture show that starch cooked below the boiling point is as easy to digest as starch that has been boiled.

The fat of foods is practically unaffected chemically by the degree of heat used in cooking.

The ideal preparation of food for human use requires that the nutriment which it contains shall be utilized to the fullest extent. Not only should the food be in such a state that the digestive juices can best act on it, but these digestive juices should be properly stimulated to do their work, by improving the taste or flavor of the food.

The present-day problem is to determine the methods of cooking which will yield the most in nutrition and flavor with a minimum expenditure of fuel and labor. The solution of this problem will require careful research by the physiological-chemist, the domestic scientist, and the manufacturer of cooking apparatus. Taking into consideration the results of experiments on the digestibility of foods cooked in various ways, the problem of the domestic scientist is to definitely determine the range of temperature and the time of cooking at each temperature for all classes of food. Effects of quality and proportion of ingredients, size of utensils and other variables must be studied so that definite rules and tables can be worked out giving the most desirable times and temperatures of cooking any article of food.

The problem of the electrical engineer is to determine, from the range of temperatures for cooking any article of food, the particular temperature which is the most economical. He must also perfect an electric cooking apparatus which will maintain the desired temperature with a minimum amount of attention, and which will be low in the first cost and economical in operation.

Losses of Energy in Electric Ovens

During the past century there has been a great advance in the methods of applying heat to food. Each improve-

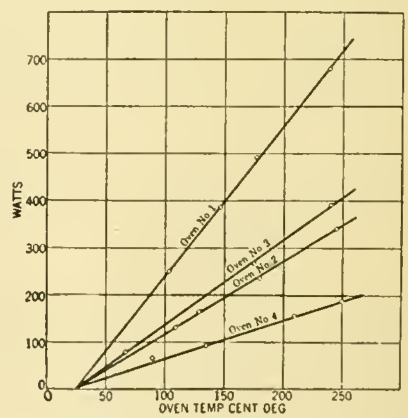


Fig. 3.—Energy required to maintain ovens at constant temp.

ment has resulted in less of the heat energy being wasted and in more being absorbed by the food. Each step, from the open fireplace to the coal range, to the gas stove and finally to the electric oven has been marked by the use of more expensive fuel, greater heat efficiency, and better control of the heat.

Except in a few localities, for the same number of heat units delivered at the meter, electricity is more expensive than gas or coal. Hence, it is only by studying carefully the most economical features of design and operation of elec-

tric cooking apparatus that electricity will be able to compete with gas and coal. A study of the heat losses in cooking is, therefore, of considerable importance to the designer of electric cooking apparatus.

Convection and Radiation

If an electric oven is supplied with heat at a constant rate, say 1,000 watts, the temperature of the oven will increase rapidly at first and then more slowly until it finally reaches a constant value. From the law of the conservation of energy it follows that if there is no food in the oven the same amount of energy is lost into the room as is supplied by the heating coil. This heat is lost in two ways, by convection and radiation.

The radiation loss consists of waves of energy similar to light waves, but of different length. The amount of the energy radiated depends upon the nature of the surface the temperature of the surface and the temperature of the surroundings. It is independent of the shape of the radiating surface. The convection loss, however, depends upon the shape and the position of the surface as well as the temperature of the surface and the surroundings. It is independent of the nature of the surface.

The radiation and convection losses from horizontal and vertical plane surfaces have been determined for various ma-

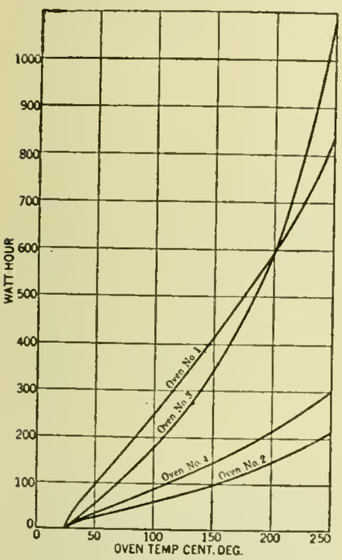


Fig. 4.—Energy required to preheat ovens.

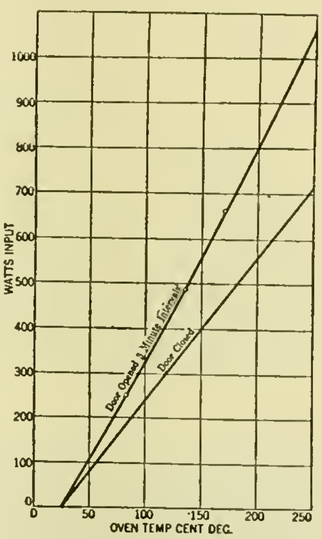


Fig. 5.—Energy to maintain constant av. temp. of oven No. 1; door opened 15", at 3 min. intervals.

terials. Fig. 2 shows the convection and radiation losses for vertical plane surfaces for temperatures up to 250 deg., the highest used in cooking.

As shown by the curves, the radiation loss from a black body constitutes a large part of the total loss, while the radiation from a polished silver surface forms but a small part of the total loss. For all other surfacs the radiation loss lies between that of a silver surface and a black surface; the convection being the same for all surfaces.

There are two ways in which the heat loss of an electric oven may be reduced. Consider an oven of given inside dimensions built on the plan of an ordinary gas oven, with a black outside surface and no heat insulation. The temperature of the outside surface will be within a few degrees of the temperature of the oven. A large amount of energy will be required to maintain a cooking temperature inside the oven. Since the convection and radiation losses depend on the temperature of the outside surface the losses will be greatly reduced if this temperature can be decreased. If the inner and the outer surface of the oven are separated a few inches and the intervening space filled with a poor conductor of heat such as mineral wool, kieselghur, or poplox, there will be a large drop in temperature between the inner and the outer surfaces, because the heat will be conducted very slowly away from the hot interior.

Suppose that enough heat insulation were introduced to reduce the outside temperature from 200 deg. to 110 deg. cent.; the watts lost per sq. cm. of outside surface would be reduced from 0.37 to 0.12 as shown by the curves of Fig. 2. Stated in another way, the energy required to maintain the inside temperature of the oven at its former value would be reduced from 1,000 watts to 325 watts for the same outside surface. For the same inside dimensions, however, the area of the outside will be larger because of the added insulation and hence the energy will be slightly greater than the above value.

Another method of reducing the heat losses would be to silver-plate the outside of the oven. The heat loss would then be decreased from 0.37 watts per sq. cm. to 0.13, or the energy required to maintain the same inside temperature would be reduced from 1,000 watts to 350 watts. By a combination of the two methods the input of the oven for the required internal temperature would be reduced from 1,000 watts to 165 watts.

To silver plate the outside surface of an electric oven would be too expensive to be practical, but there are cheaper surfaces which radiate a small amount of energy compared to the ordinary black oven. A white enameled surface, for instance, would be much more efficient than the black surface. A place in which nickel plating could be used to good advantage would be around the edge of the oven door. Because of the good heat conductivity of the metal which connects the inner and outer surfaces of the oven around the door, the outside temperature of the oven is considerably higher around the edge of the door than elsewhere on the outside. If the nickeled plating now used on the legs and the corners of the stoves were put around the edge of the door, it would help to decrease the losses and the cost of the oven would be no greater.

The heat losses from an electric oven can be easily determined by measuring the energy input and the temperature after the equilibrium conditions are established. The heat losses for the ovens tested were obtained in the following manner: A thermo-couple inside the oven was connected to a recording galvanometer. A given amount of energy was turned on so that the temperature of the oven increased, until finally, the heat lost equalled the energy measured by the wattmeter. The tests were continued until the oven temperature had remained constant for at least two hours. This was repeated for other values of energy input and curves were plotted between oven temperature and watts input as shown in Fig. 3. It will be noticed that the curves obtained are straight lines, all cutting the temperature axis at room temperature. Although very exact measurements might show a slight upward tendency at higher temperatures, the present results with a maximum error of 2 per cent. are sufficient for practical use.

Since the character of the surface and the outside area will remain constant for a particular oven the above curves showing the relation between oven temperature and the energy lost by radiation and convection should be similar to the curves shown by Fig. 2 (Langmuir). The apparent discrepancy can be accounted for in that the greatest outside temperature of the ovens tested was only 80 deg. cent. and below that temperature Langmuir's curves do not depart perceptibly from a straight line.

As will be shown later, the temperature energy curves of Fig. 3 are very useful in comparing the economy of various ovens for the cooking of any article of food. Since one point of the curve will be zero energy at room temperature, only one determination is necessary to plot the curve for any par-

ticular oven. For a given room temperature, measure the watts input and the temperature of the oven after it has become constant. A straight line between this point and a point on the temperature axis will give the heat lost from the oven at any oven temperature. These results give the energy lost through the insulation and the metal around the edge of the door.

Preheating

The heat losses of an electric oven may be separated into the losses occurring before and after the food is inserted in the oven. In many kinds of cooking, such as baking biscuits and cake, the food must be placed in a hot oven as soon as it is prepared. Since for domestic purposes an oven is never used continuously, it cools off during the interval in which it is idle. Before it can be used again the inside of the oven and the enclosed air must be heated up to a cooking temperature. This operation is called preheating. The amount of energy required to preheat an oven to the desired temperature depends on the insulation of the oven, its size and the thermal capacity of the inside, and the size of the heating coils. The amount of energy required to preheat the ovens tested was obtained by taking simultaneous readings of the temperature and the watt hour meter. Fig. 4 shows the results obtained. It will be noticed that although oven No. 4 was better insulated than oven No. 2, it required more energy for the preheating. This was probably due to the greater heat capacity of the inside lining and the insulation. The effect of too small a heating coil is shown for the curve for oven No. 3. For big temperatures, the energy required for preheating this oven is altogether too large for the size of the oven. The time required for the oven to reach a baking temperature of 250 deg. cent. was 2.5 hours. In order that the electric energy for preheating shall be as small as possible the inner parts of the oven should have as small heat capacity as is practical and the heating coils should be large enough to heat the oven to the desired temperature a fairly short time. If the time required for the oven to reach the desired cooking temperature is excessive not only is there a delay in the cooking operation, but a larger amount of the energy is lost into the room by radiation and convection during the preheating.

Heat Loss When the Oven Door is Opened

In preparing food which cannot be placed in a cold oven and heated gradually, there is a loss of heat when the oven door is opened. The amount of this loss and the fall of temperature of the oven were determined for oven No. 1 as follows: the energy input was measured by means of a watt meter and was kept constant for each test. The temperature of the oven was obtained by means of a thermocouple and the recording galvanometer. The variation of the temperature when the oven door was opened for 15 sec. at 3 min. intervals was determined. The average temperature gradually changes and finally reaches a constant value. A curve plotted between these average temperatures and the energy input is shown in Fig. 5. The difference between the ordinates of this curve and the similar curve obtained with the door closed evidently represents the energy lost by opening the door. From these values the energy lost each time the door is opened is readily calculated.

[Our next issue will describe specific experiments in roasting and baking.—Editor.]

Athens to Put in New Plant

The village of Athens, Ont., contemplates installing an electric lighting system and is calling tenders. The capacity of the system required will be approximately 1,000 twelve watt lamps. Provision is made for a street lighting system to use 50 twenty-five watt lights installed on goose-neck fixtures with simple reflectors.

Bell Tel. Co. Have Sent Many Men

The Bell Telephone Company are doing their share in the work of defeating the Germans. About 180 men have gone to the front, and every one of these, said Mr. C. F. Sise, Jr., managing-director, in addressing a recruiting meeting of the employees of the company, had his position assured for him when he came back. The company are also giving half pay to the dependents of the married men at a cost of $45,000 a year. "Hitherto," continued Mr. Sise, "we have preached recruiting amongst the unmarried men. Now we are calling upon all fit men to take their share in the great fight for freedom. We ask you to do your share, you can see that the company is doing its end."

State Regulation of Electrical Utilities

In the report of the Public Policy Committee presented at the Annual Convention in San Francisco recently, a chart was published to show the extent of the regulation of electrical utilities by state public service commissions. The committee called attention to the fact that the practice of regulation has been continued without exception where it was in effect previously, and since January 1, 1914, has been adopted also by three more states. Thirty-two states and the District of Columbia now have commissions regulating electric-lighting utilities. There are only fifteen states without such regulation.

Average Life 1,500 Hrs.

The Hamilton Hydro-electric Department, Mr. E. I. Sifton, chief engineer, make careful records of the life of their different lamps, and so are accumulating interesting and valuable information regarding the relative merits of the various types. During 1914 the city installed approximately 1,000 500-watt nitrogen lamps and a report of May 22nd, this year, states that 977 lamps had given a total of 1,456,848 hours of light. This is an average of 1,491 hours per lamp, including all troubles. Even at that, a very large percentage of the original lamps were still in operation.

Lighting St. Hilaire

The municipality of St. Hilaire, P.Q., propose to construct a distribution system for public lighting and power. A contract has been made with the Southern Canada Power Company for the supply of current, which will be delivered from the company's transmission line from St. Hyacinthe to St. Johns. The same company have also contracted to furnish power for the new ammunition factory now being constructed at Drummondville for the Aetna Explosives Company. Tenders for the installation of the lighting system are now being called.

Further Niagara Development

Mr. P. A. Porter, associate of Dr. T. Kennard Thompson, a Canadian engineer practising in New York, recently outlined, before the Joint Legislative Commission of New York State, a scheme for the development of further power from the Niagara River. Mr. Porter's plan in various forms has been suggested before, which is the construction of a dam eighty feet high across the gorge some three-quarters of a mile above Lewiston and below the main rapids. A dam of this height, it is said, would impound the river waters to within about a mile of the present falls and would obliterate the main rapids and the whirlpool. Mr. Porter's rough estimate mentioned 2,000,000 h.p. and a total capital expenditure of $100,000,000.

Low Tension Electrical System

In new Head Office Dominion Bank Building, Toronto—Interconversing, buzzer and signal systems a marvel of present day ingenuity and efficiency

The low tension installation in the head office building of the Dominion Bank, Toronto, is remarkable in its completeness. A brief description with interesting illustrations is given herewith. This low tension system consists of a complete installation of interior telephones of the Turner Inter-conversing System, and a remarkable system of push buttons, buzzers, lamp type annunciators, etc.

The system evinces great thought on the part of the architects and engineers, and a close study of the requirements of their clients. The design and installation tend to contribute (a) to the convenience of the executives; (b) to the efficiency of the staff; and (c) to the service given clients.

The Inter-Conversing System

The installation embraces 48 stations, consisting of four master stations—situated at the desks of the general manager, the assistant managers, and the local manager. These master stations are connected to the other stations, which are located at different desks in the general offices on the 9th and 10th floors, and the main banking room, savings bank department, and vaults on the lower floors and basement.

Fig. 1 shows a master station built into the roll-top desk. Fig. 2 shows a small station typical of a number located at various points throughout the building. Fig. 3 shows a small station built into a roll-top desk.

By means of this system, instant communication may be had between the different members of the staff, tellers, book keepers, and various other departments located on different floors of the building. Complete inter-communication may be had between any of the stations installed. In the case of the master stations, all that it is necessary to do in order to get into communication with another station is to simply press a key. This gives a signal at the desired station; the

Fig. 1.—Master station built into roll top desk.

man at the end of the line receives the signal the instant the button is pressed. There is no waiting, no switchboard connection to be made, no switchboard operators entailed, and in addition to this, no mouthpiece or earpiece are necessitated in the operation. Through a loud-speaking device the voice of the party called comes to the executive, and conversation is held as if the party called were present in the room. The conversation is carried on in a direct manner and is private, as there is no chance of anyone breaking in on the line. An earpiece is provided, so that if on any occasion the loud speaker is not desirable, this earpiece may be lifted from its hook, automatically shutting off the loud-speaking device, when the conversation is heard through the earpiece in the regular manner.

The instrument sits on or in the desk; but once the key is pressed, the speaker may carry on the conversation from

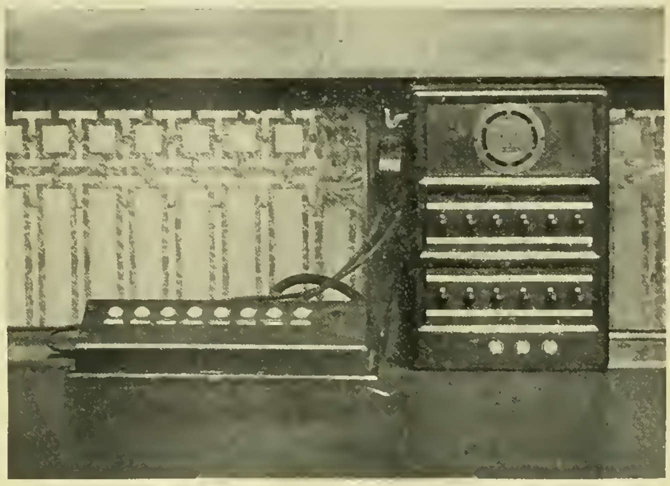


Fig. 2.—Typical small station—many located throughout building.

any part of the room. In addition to the buzzer signal given when the master station calls, there is a series of lamp annunciators located on the instruments; so that when two of the sub-stations are in conversation, and the executive officer calls from a master station, the light corresponding to his signal shows; by this means his call may be attended to at once or at the discretion of the party on the other end.

By means of this system the master station can call as many of the sub-stations as he desires, and a conference may be had over the phone. The voices of all parties engaged thereon may be heard distinctly, not only at the master station, but by each individual on the different lines connected.

In addition to being a most convenient system for interior communication, this system relieves the outside Bell system and switchboard, of all interior calls; thus leaving the Bell system free to handle all outside business.

Buzzer and Signal System

In addition to the telephone system described above, there is a complete buzzer and signal system. All the important desks are fitted with special type mats with buttons, which operate the buzzers and signals for the individual requirements. Each buzzer is connected at the same time with a lamp type annunciator. Different forms of these annunciators may be seen in the various plates accompanying this article. Fig. 2 shows the desk type lamp annunciator; Fig. 3 shows lamp type annunciator fitted into a pigeon-hole desk. Fig. 1 shows mat of buttons fitted into side of roll-top desk. Fig. 4 shows a row of lamp type annunciators in edge of counter. The latter signals are for the messengers.

The signal is given by the pressure of a button at the desk calling; the buzzer sounds, and its corresponding light glows in the annunciators. This light continues to glow until the call has been answered; it is then put out by the pressure of a button beneath the bull's-eye. This does away en-

Fig. 3.—Small station built into roll top desk.

Fig. 4.—Row of lamp type annunciators in counter.

tirely with repeated buzzer or bell calls, and in addition it registers the call until it is attended to without further thought on the part of the party calling. The buzzer and lamp calls are operated by a system of relays on each line.

The power for the signal system is obtained from two sets of storage batteries in the basement, which in turn are kept charged by motor-generator set operating off the generating plant. A unique charging device has been installed in the basement in the shape of an automatic charging apparatus. By means of this apparatus, the batteries as they need charging, are thrown off the line and are automatically charged by the motor-generator; at the same time the charged batteries are connected and maintain the service. One set of batteries is, therefore, always charging. The automatic device not only regulates the charging, but periodically automatically tests the batteries for drop in voltage.

The maintenance here is as nearly automatic as possible; if a ground should develop on the system, the same is shown on the board by means of red signals. The feeder cables

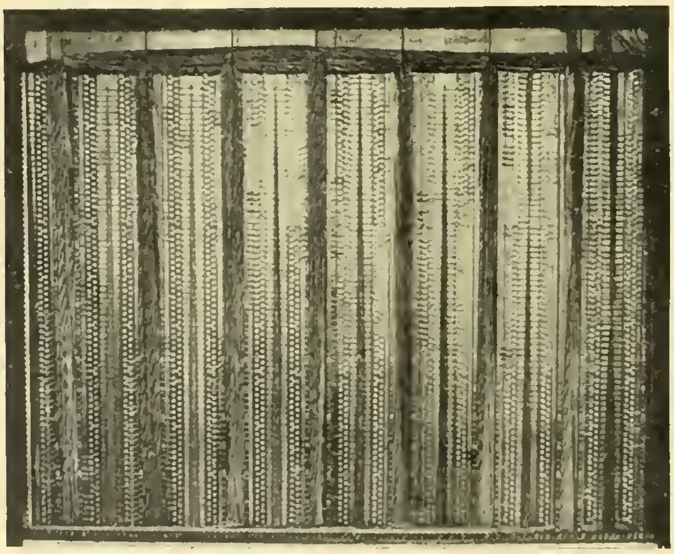


Fig. 5.—Feeder cables end in intercommunicating strips.

end in inter-communicating strips as shown in Fig. 5. There are two terminal boxes such as illustrated, and by means of these any change in the connections can be made with the greatest of ease. The connections to the desks are made through separable connectors, so that any change in the location of furniture may be made without any ill effects to the system.

The entire low tension work has been installed by L. K. Comstock & Company, of Montreal.

B. C. TELEPHONE CO. BETTERMENTS

New Work Approved Will Cost $70,000—First 800 Pair Cable to be Strung in Vancouver

To cope with the present needs of the system and to provide facilities for the large increase of business that is certain to follow the trade revival looked for after harvest, the British Columbia Telephone Company, Limited, has planned to expend the substantial sum of $70,000 in the further improvement of their lines in Vancouver, North Vancouver, Victoria, and Nanaimo, in addition to appropriations previously allotted for work in the Fraser Valley and Lulu Island lines, and at points in the interior of the province. It would form an interesting chapter if we could outline just how intimately the service of this great corporation is bound up with the various enterprises carried on at all points, but space will not permit. Certainly it plays an important part in the business and social life of most residents, and the news that the company has authorized a further heavy expenditure at a time when so many firms are conserving their capital is an expression of confidence in the future that is particularly well timed and should be productive of happy results in the encouragement of a spirit of genuine optimism.

In the Fairmont exchange district, Vancouver, an underground six-duct conduit is being laid on Kingsway between Prince Edward Street and Fraser Avenue to take care of additions to plant in the south-eastern portion of the city and also to provide trunk cable to the Fraser and Collingwood branch offices. The work will involve the laying of one 300-pair cable and one 100-pair cable, the estimated cost being $14,300.

In the East Bayview district an expenditure of $7,900 will cover the placing of an 800-pair cable—the first in Vancouver—between the Bayview office and Maple Street, and a 400-pair cable between Maple and Cedar Streets. Underground cable is to be used in connection with the aerial cable on Cedar Street between Twelfth and Seventeenth Avenues.

The improvements in West Bayview will cost $7,500, and will include one 600-pair cable between the Bayview office and Vine Street, on Tenth Avenue; one 400-pair aerial cable from that point to corner of Collingwood Street and Tenth Avenue; one 100-pair cable on Trafalgar Street from Tenth Avenue to Fourteenth Avenue; one 100-pair cable on Im-

perial Street from Tenth Avenue to Fourteenth Avenue; and one 100-pair cable on Sasamot Street between Tenth and Twelfth Avenues.

Cable extensions in North Vancouver along Fourth, Eighth, Ninth and Tenth Streets and the Esplanade will call for an outlay of $1,800, in addition to the cost of new service work asked for by residents on Fell Avenue, Keith Road and Capilano Road.

On Vancouver Island an extensive programme of work is being proceeded with, which will entail a heavy expenditure. In Victoria an underground conduit will be put in which will link up the Fort Street underground with the underground of Pandora Street, this work having been delayed as a result of city operations in the vicinity. This conduit will connect with aerial cables on Oak Bay Road and Fort Street, and will permit of redistribution of the entire cable plant in the Oak Bay district and relieve existing congestion. Cable extensions are also to be made on Cadboro Bay Road, Mount Tolmie Road and a number of connecting avenues, the estimated outlay being approximately $10,000.

In the Fairfield section of the city a 400-pair cable is to be placed in Linden Avenue between Fort Street and Fairfield Road which will admit of the re-arrangement of cables in that district. Included in this $3,000 estimate is a 100-pair cable extension on Beach Drive from Foul Bay to Monterey Avenue.

To cope with the needs of Victoria West and Esquimalt a 200-pair submarine cable will be laid across the arm to connect with aerial across the Indian reserve to foot of Wilson Street; a 100-pair cable on Craigflower Road and on Esquimalt Road to the navy yards. This work will cost $6,500. A 600-pair cable will also be laid underground between the Victoria office to the corner of Oak Bay and Fort Streets, and a 400-pair cable from the corner of Vancouver and Johnston Streets to the corner of Fort and Linden Streets, at a cost of $12,600.

Improvements to be made in Nanaimo include the placing of conduit on Fitzwilliam Street, with a 600-pair cable to provide additional facilities in the residential section of the city; a 200-pair cable on Fraser Street; a 100-pair cable on Milton Street; a 50-pair cable on Wentworth Street; poles and a 100-pair cable on Nicol Street, and a mile of poles out along Farquhar Street.

In addition to the work now in progress in the Milner and Cloverdale districts of the lower Fraser Valley, approximately forty miles of new wire will be strung on Lulu Island to care for new subscribers who will be served from Eburne exchange.

At Rossland, in the interior of the province, 50-pair cable extensions and terminals will be made on Washington Street and along Columbia Avenue, with small branch cables connecting. This work will permit of the removal of open wire along these routes, as well as provide for future growth to be expected in this brisk mining town.

At Nelson all open wiring will be removed from the principal streets. Poles will be taken off Baker Street and new ones set in the lanes parallelling that thoroughfare on both sides. General improvements and extensions will also be made at a cost of several thousands of dollars.

The Kootenay district service is also marked for betterment in the way of equipment, etc. At Sandon a new switchboard and main frame are being installed, and similar work for New Denver exchange is under consideration. Improvements will be made on the nine-mile toll line between Patterson and Rossland, which connects Nelson long distance lines with Spokane, and the toll line between Nelson, Balfour and New Denver will also receive attention.

The Effective Illumination of Streets

A discussion of the fundamental purposes to be served by Street Illumination, and the best methods to adopt under varying conditions

By Preston S. Millar*

The effectiveness of street illumination depends upon the following:

Intensity of Light upon the Street.—There is no single measure of intensity which serves all purposes. The average horizontal intensity upon the street surface is most nearly satisfactory.

Brightness of Street Surface.—Adopting automobilist's viewpoint as to angle and direction.

Relation between Lamps and Street Surface.—Visual angle between the two, and extremes of contrast encountered.

Contrasts Produced on the Street Surface and on Objects on the Street.—This is largely a function of the direction of the light.

Portion of Total Field of View Illuminated.—This may be affected either by the number of lighted lamps within view or by the area of surface which is illuminated.

Appearance of Installation and of Street by Day and by Night.—Lamps, fixtures, light distribution, etc.

Installation Factors

Each of the foregoing variables upon which street lighting effectiveness depends is affected by four or more principal installation factors.

Size of Lighting Units and Spacing Intervals

Power of Lighting Unit.—There is now a general tendency toward the adoption of more powerful lamps of one of three types. Of these the flame arc lamp and the multiple Mazda C lamp depreciate in candle-power 20 to 25 per cent. throughout life. The magnetite lamp and the series Mazda C lamps do not change materially throughout life.

Large versus Small Illuminants.—The cluster of lamps employed so largely in "ornamental or white way" lighting during the past five years has yielded favor in most recent installations to the single illuminant or less frequently to twin illuminants on one post.

The effectiveness of the light, other things being equal, is dependent upon the choice as between many small lighting units and few large lighting units. In favor of the small illuminants it is urged that greater uniformity results from their use; that they may be mounted lower, thus avoiding shadows from trees, etc.; and it is added that when small illuminants are mounted low, a larger percentage of their total flux is distributed over the street surface. On the other hand, it is argued in favor of large illuminants that they are relatively less costly per mile, and that usually the appearance of a street lighted by them is more pleasing.

There are two considerations not usually urged in this connection. Large illuminants are favored from this viewpoint because they may be placed well out over the middle of the street, where the specular reflection from street surfaces allows the light to be applied in a more favorable direction than that from small illuminants which usually are mounted low over the curb. An example of ineffective use

* Concluded from July 15 issue).

of small illuminants will occur to all who can visualize a wide, wet street with lamps over both curbs. The lighting of the street surface consists of a few bright streaks near the curbs, while the middle of the street is dark. As modern street pavements are extended, and automobile traffic increases, the advantages of mounting lamps well over the centre of the street tend to increase, and the disadvantages of small illuminants mounted low over the curbs tend to become more apparent.

The second consideration was brought out prominently last year by the Street Lighting Committees of the National Electric Light Association and the Association of Edison Illuminating Companies. It was shown that within reasonable limits, uni-directional light is to be preferred to multi-directional light because it enhances contrasts upon which discernment is dependent. Objects and surface irregularities are seen more surely by uni-directional light than by light coming from a number of directions. From this it follows that, other things being equal, the revealing power of a few large illuminants is greater than that of many small illuminants, especially if the latter are staggered along both curbs.

While these considerations do not clearly indicate the desirability of large units, they do add weight to the arguments in their favor.

Lighting Accessories

Improved Distribution.—The most desirable distribution of light depends largely on the nature of the street surface and on the character of the street. Hence there is no such thing as a correct distribution characteristic for all street lighting. The prismatic refractor is successful in providing a distribution characteristic which for a vertical plane conforms to the theoretical requirements as laid down by some engineers. In other forms it will doubtless provide different distributions as required. It is an admirable device so far as re-direction of light is concerned. However, it is objectionable in some forms because of excessive brightness, due to its small size. Also when combined with the casings with which it is usually employed, its appearance is not attractive. Probably in the evolution of this useful device these objections will be overcome.

The same considerations which underlie the design of the refractor, namely the desire to increase the intensities on street surface at a distance from the lamps, would appear to favor the adoption of assymetrical horizontal distributions whereby light which normally is delivered upon surfaces lying along the sides of the street, is directed upon the street surface. Lighting accessories to accomplish this purpose have been devised but thus far have not received the extensive trial which their theoretical advantages would appear to warrant.

Diffusing Globes.—The employment of diffusing globes to decrease brightness of light sources in the street has become more general in recent years. Perhaps the extreme example in the way of increased size of such globes is found in the Washington, D.C., installation of ornamental magnetite lamps, in which 28-inch built up alabaster globes of rather high density are employed. As compared with the use of a clear globe or of a lamp with no globe, a diffusing globe of fairly large size is usually desirable because it improves the appearance of the lighting unit, renders the appearance of the street more pleasing and promotes good conditions of visibility.

It is desirable to secure the best possible balance between low light absorption and good diffusion when selecting diffusing globes. Test data on these two characteristics are of importance and should not be neglected. Because of neglect of simple and inexpensive tests of commercially available glassware, globes are being installed which do not accomplish the purposes in view so well as would other glassware. These either absorb a larger percentage of light than is necessary to secure the desired degree of diffusion, or else diffuse less well than need be, considering the amount of absorption.

Protection for the Eyes.—At first glance it would appear that street lighting purposes would be served admirably by a lighting accessory which would concentrate a large proportion of the light flux upon the street surface while directing but little light at those angles which fall near the centre of a field of vision in a given installation. However, certain difficulties operate against the success of such a scheme. With practicable mounting heights, spacings have to be short if this is to be successful in illuminating the entire length of the street. The general direction of the light in such an installation is much more largely downward than is usually the case. Wherever there are sufficiently short-interval spacings to allow of such an installation, there usually exists a requirement for lighting the building fronts. In such installations the relatively high intensities on the street surfaces, together with the large areas of considerable brightness which present themselves to view, render the glare negligible when ordinary diffusing globes are used. That is to say, in the only installations where it is practicable to use such devices, their eccentric distribution characteristics are unnecessary. Where the surroundings are such that the lighting of building fronts is undesirable or unnecessary, spacings are usually too great to admit of the use of such devices, because their illuminating range is too small. Also considerations of street surface characteristics, discussed elsewhere, suggest that suppression of light at say 80 deg. may do more harm by lessening the pavement brightness than can be compensated by decreased brightness of source.

Location of Lighting Units

Comprehended under this heading fall such subjects as height, transverse location and spacing. In most city installations these aspects are standardized for a particular street. In lighting of inter-urban roadways, lamps are sometimes located in accordance with best judgment, varying considerably in all these particulars.

Location Transverse of Street.—As between centre and curb locations there is a considerable difference. In the first place with lamps located over each curb, the street appears much wider. In the lighting of important city streets this is usually a desirable condition. The lamps mounted over the curbs likewise illuminate the sidewalks and the fronts of buildings better. When, however, the lighting of the roadway becomes of first importance, as in streets of the 3b class, the best use may be made of the light by locating the lamps as nearly as practicable over the roadway so as to take full advantage of all specular reflection from the street surface.

Height.—In regard to heights of lamps there is also a wide difference in requirements, depending upon the character of the street. In some of the latest practice, powerful lamps are located 14 to 18 feet over the curbs on business streets. These, however, are backed by light colored buildings and the entire surrounding is so brightly lighted that the glare is not bad. With lamps over the middle of the street the background is usually the dark sky, and usually there are not light colored buildings to relieve the general darkness. Under these conditions the opportunity for glare to become serious is considerable and it is therefore necessary to locate the lamps rather high. The improvement realized in increasing the height of lamps of moderate power from 18 to 20 feet is considerable, while the improvement in increasing the height from say 27 to 30 feet is not very great. The curve of glare falls off rapidly with increasing separation when the separation between the light source and the observed surface is only a few degrees. Around a lamp which has a dark background there is a zone of halation within

which objects tend to become invisible. Once outside this zone, the glare effect falls off less rapidly. It is very important to mount the lamps high enough to insure that the separation from the street surface is at least sufficient to avoid this zone of serious glare.

Power of Unit as Related to Glare.—Other things being equal, the objectionable effects of glare are greater when the lighting units are more powerful. Hence it is approved practice to mount the more powerful units higher than less powerful units.

It must be recognized that a bright light source obscures its immediate background. This obscuration is greater if the light source is brighter or more powerful, and is less if the background is brighter. In country roads or park drive lighting such obscuration is often very serious. Recognizing the truth that under such conditions the bright light sources will obscure a certain region of the field of view, the source should be so located that the background which it obscures is one which it is not important to see and that the surface which it is desired to see is sufficiently separated from the glaring light source to avoid difficulty.

Spacing.—All features of an installation should be treated in such a way as to avoid dark areas between lamps, coupled with low mountings for very bright and powerful lamps. To avoid ineffective results due to multi-directional light which reduces contrasts, spacings need to be greater when the lamps are staggered along both curbs than when they form a line along one side or over the middle of the street. The best spacing would appear to be contingent upon the kind of pavement employed and the nature of the surroundings. All the other factors should be so handled that in driving, one will not encounter the bad condition of a bright light source preventing an adequate view of the surface of the street beyond it.

New Safety Rules and Regulations

The managing committee of the Electrical Employers' Association of Ontario, composed of the electrical employers in this province coming under class 38, schedule 1 of the Workmen's Compensation Act, have compiled a set of safety and operating rules calculated to govern operations of the various employers and their employees. The managing committee is composed as follows: Three members representing central stations, two members representing power plants, one member representing power plants, one member representing wiring and one member representing telephone companies and one member representing electrical manufacturers. These rules have been approved by the Lieutenant Governor in Council and the Workmen's Compensation Board and hence are as binding as if they had constituted a part of the original act. Electrical employers are then under an obligation equally binding, for humanitarian, financial and legal reasons, to see that these rules are put into effect to the letter. A copy of the safety and operating rules is printed below:

GENERAL RULES.

General Rule 1.—All Employers in Class 38, Schedule 1, of the Act. shall send to the Association duplicates of all notices and reports sent to the Workmen's Compensation Board at the time when such notices and reports are sent to the Board, with any comments as may be desired, and shall also supply the Association with detailed information of all advances made to Employees in respect of accidents at the time when such advances are made.

General Rule 2.—All Employers in Class 38, Schedule 1, of the Act shall give free access to their plants to the Inspector of the Association. The Inspector shall have the right to question employees in the presence of the employer or his representative, in regard to the operation of the plant.

General Rule 3.—All employers shall furnish their employees whose risk is carried under Class 38, Schedule 1 of the Act, with a copy of the following Safety Rules.

General Rule 4.—In case of any such violation of any of these rules as appears to the Managing Committee to call for an investigation, the Committee shall investigate the circumstances and shall report the violating Company to the Workmen's Compensation Board if the results of their investigation, in their opinion, warrant them in doing so.

General Rule 5.—In case of an inquest being held that affects the Employers in Class 38, the Inspector is authorized to attend and represent the Association.

SAFETY AND OPERATING RULES.

A. General.

Rule 1.—Safety should be secured by taking proper precautions and by seeing that the existing danger, if any, is understood and recognized, rather than by unduly emphasizing the danger and thus causing nervousness.

Rule. 2.—Workmen should thoroughly familiarize themselves with such rules as may be laid down for their guidance. A large proportion of accidents are caused by disregard of instructions or by thoughtlessness or forgetfulness. Accidents of this kind cannot be wholly avoided by means of rules or other safeguards. Workmen should therefore cultivate the habit of caution and a strict regard or instructions, danger notices, etc.

Rule 3.—Workmen engaged upon electrical work should have a clear understanding either through experience or by instruction as to the nature of the operation they may be called upon to perform, its object and the probable result.

Rule 4.—All work in which a hazard exists should be under the supervision of an experienced and competent workman.

Rule 5.—The workmen should be informed of existing danger and the nature of same and the precautions to be observed clearly explained to them.

Rule 6.—All workmen shall use the safety appliances provided for them and warranted by the work in hand, such as insulated platforms, insulating shields and barriers, rubber gloves, etc., but such appliances provided to protect the worker against injury should be used carefully and not with over-confidence in their effectiveness.

Rule 7.—The exercise of personal caution alone may not prevent an accident occurring. Workmen should see that their fellow-workmen do not disregard the rules and take chances. They should also warn others (without alarming them) should they be discovered in a dangerous position or about to take an unnecessary risk.

Rule 8.—Employees should promptly report any condition which may endanger life or property.

Rule 9.—Workmen should refuse to do any work which they believe themselves unable to perform safely.

Rule 10.—Employers should furnish reasonable facilities to their workmen for instruction and practice in approved methods of resuscitation, first aid and fire extinguishment, and all workmen engaged upon electrical work should fam-

iliarize themselves with such methods as much as possible and these methods should be studied and practised.

Rule 11.—Electrical equipment and lines not positively known to be dead are at all times to be considered alive. Precautions are to be taken so that it will not be possible for any dead equipment or lines to become alive until all workmen are clear.

Rule 12.—The use of ladders reinforced with wire or other metal is absolutely prohibited.

B. Installation of New (Dead) Apparatus.

Rule 1.—The work should be under competent supervision.

Rule 2.—Scaffolding should be erected carefully and the necessary time taken to make it safe and sufficiently strong for its purpose.

Rule 3.—Defective ladders must not be used and should be either repaired or discarded. Ladders should be secured at both ends against slipping.

Rule 4.—Workmen should be careful not to drop, leave in a position where they are liable to drop, or throw tools or other articles from scaffold, pole, tower or other elevated positions.

Rule 5.—Lifting devices such as cranes, chain blocks, derricks, rope, cable, slings, jacks, tackle, etc., should not be taxed beyond their rated capacity. Workmen should satisfy themselves that such equipment is in good condition and quite safe for handling the load.

Rule 6.—The handling of extremely heavy apparatus should be under the direction of men experienced in this class of work.

Rule 7.—Steel cable or good hemp rope should be used for lifting, in preference to chains. If the latter are used they should be carefully examined and annealed periodically.

Rule 8.—Workmen should never stand upon a load being lifted by a crane or remain in a position where the breakage of a sling or other tackle might cause injury, or stand in the bight of a rope or cable.

Rule 9.—Care should be exercised in using gasoline to guard against fire or explosion.

C. Installation or Repair Work in the Vicinity of Live Apparatus or Lines.

Rule 1.—Danger notices should be displayed but only where actual danger exists. They should be such as to attract attention.

Rule 2. Where work is being carried on in the vicinity of live apparatus or wiring, barriers should be erected or other suitable precautions taken to prevent accidental contact. Barriers may consist of wooden railings, ropes or some such temporary structure securely attached. Where the work to be done is quite close to live parts, insulating barriers should be interposed to shield the workmen against personal contact or accidental short circuit.

Rule 3.—Where work under these conditions is to be performed on scaffolding or on an elevated position, special care should be taken to guard against falling. A slight shock might cause a workman to lose his balance and fall to the ground or among live conductors.

Rule 4.—Workmen should endeavor to avoid slipping or stumbling in the vicinity of live apparatus or wiring and should be particularly cautious when moving backwards.

Rule 5.—Suitable clothing should be worn by all whose duties require them to be in the neighborhood of moving or live apparatus or wiring. Loose clothing, rolled up sleeves, and metal articles such as watch chains, belt buckles, finger rings, etc., should be avoided.

Rule 6.—All workmen engaged upon this class of work should be carefully and earnestly instructed as to the live parts, so that there will be no doubt as to the nature and location of the danger.

Rule 7.—Workmen should be careful not to drop or throw tools or other articles from scaffold, pole, tower or other elevated positions.

Rule 8.—The work should be under competent supervision.

Rule 9.—Scaffolding should be erected carefully and the necessary time taken to make it safe and sufficiently strong for its purpose.

Rule 10.—Defective ladders must not be used and should be either repaired or discarded. Ladders should be secured at both ends against slipping.

Rule 11.—The use of ladders reinforced with wire or other metal is absolutely prohibited.

D. General Operation

Rule 1.—All operating companies should have such operating rules in addition to but not in conflict with the rules of the Association as may be found necessary to insure the safety of their workmen. A copy of these rules should be filed in the office of the Association.

Rule 2.—Adequate records of operation shall be kept.

Rule 3.—The starting or stopping of apparatus, opening or closing of switches shall be carried on under the control of a duly authorized person.

E. Handling Live Equipment and Lines

Rule 1.—In the event of a circuit breaker being opened or other apparatus taken out of service for the purpose of repairs or other work, the switches or other controlling devices should be properly tagged and clearance given to the workman in charge of such work; these switches may not be closed or apparatus started or put into service until the person to whom the clearance has been given has reported clear. In such cases the workmen in charge of the work must see that necessary protective devices are in place before proceeding with the work.

The operator who gives the clearance shall transfer this to his relief only after the relief has read the record of the clearance in the log book and has signed the log book accepting the responsibility.

The workman who takes the clearance may transfer this clearance in the following way:

By personally informing, telephoning or wiring the operator from whom the clearance was received, advising of the transfer, at which time the record of this transfer shall be put in the log and the workman having the clearance transferred to him shall be held responsible for the safety of the original holder of the clearance as far as it is affected by the clearance.

Rule 2.—Workmen shall not touch parts differing in potential nor exposed live parts unless adequately protected.

Rule 3.—Workmen shall not work on any live apparatus that has a potential to ground of over 3,000 volts.

Rule 4.—Workmen working on low tension lines but in the close proximity of lines of dangerous voltages shall exercise special care because of the possibility of contact between the two sets of lines. In stringing wires near live lines, the wires being handled should be treated as alive unless they are effectively grounded.

Rule 5.—Workmen must not place dependence for their safety on the insulating covering of wires.

Rule 6.—Workmen must not work from above on exposed live parts of equipment or lines when the work can be done from below. Workmen should avoid working on equipment or lines from any position by reason of which a shock or slip might tend to bring the body toward exposed live parts.

Rule 7.—Workmen shall not open a loaded circuit except at the circuit breaker provided for the purpose.

Rule 8.—Loose conductors shall be run in such a man-

ner that they cannot accidentally come in contact with any live part.

Rule 9.—In connecting dead equipment or lines to a live circuit by means of a connecting wire, workmen shall first apply the wire to the dead part before attaching it to the circuit. When disconnecting, the live end shall be removed first.

Rule 10.—In applying a grounding device to normally live parts the device must be grounded before bringing it near the parts and must be removed from the live parts before removing it from the ground connection.

Rule 11.—Live series circuits or secondaries of loaded current transformers shall never be opened.

Rule 12.—Workmen must keep all parts of their bodies as distant as possible from brushes, commutators, switches, circuit breakers or other parts at which arcing may occur during the operation or handling. If the hands must be used near such parts, additional precaution by insulating gloves is recommended. If the eyes are not otherwise shielded from possible arcing, additional protection by goggles is recommended.

The Jitney Bus—A Word of Advice

The Southern California Edison Company, Los Angeles, has issued a timely bulletin to its employees giving practical and interesting advice on the patronizing of local electric traction lines in connection with the invasion of the jitney bus. The arguments set forth in favor of the electric car are concise and logical "Reasons Why," creating thought and consideration for the established carrier system, and leading to an earnest appreciation of the advantages attending its support. As a basis for similar activities by other companies, to inspire a proper regard for electric traction lines and the benefit they bring to a community, these suggestions, as follows, are particularly opportune:

The suburbs of our cities have been made accessible and built up by the electric roads. If all the traffic obtained by them was on their lines beyond the jitney zone, they would operate at a loss, therefore it is unfair not to patronize them on short trips.

The street railway companies are large contributors in taxes to the city, county and state. Should their business be made unprofitable the public must necessarily make up this amount.

It requires 15 to 20 jitneys to furnish the carrying capacity of an ordinary street car. If all traffic depended upon jitneys the congestion would make the streets impassable.

The car companies bear the cost of maintaining one-third to two-thirds of the surface of the streets they use. If they were put out of business the jitney owners would not assume this expense but it would fall upon the public.

The jitneys do not go into territory sparsely built up or unsupplied by street cars but seek to take traffic already developed by the car companies.

The electric cars give a longer ride for the charge made than any other transportation system.

The car lines are great equalizers of rentals and values. If the entire population of any of our cities or towns was obliged, because of lack of transportation beyond, to live within the jitney (5 cents) zone, rentals and values within that radius would materially increase the cost of living. A suburban home would be prohibitive for any of us without maintaining a private conveyance.

The car lines are limited by ordinances to certain routes, schedules and rates, while the jitneys are unrestricted, therefore the car service is dependable and certain and the jitney service unreliable.

The jitneys will not extend their radius of operation as an accommodation but only on an increased charge.

Recent rulings are to the effect that accidents to employees, going to or returning from their employment, are not covered by indemnity insurance which all employers are obliged to furnish. Therefore, if you use a jitney on such trips consider the responsibility of the owner before taking the risk, which is about ten times as great in a jitney as in a street car.

A regulated jitney service may make a useful place for itself, but in an attempt to take the traffic developed by street car companies they are wrong and should not be encouraged.

Think this over. There is a principle of fair play involved.—Electric Traction.

Montreal Tramways Annual

Though the fiscal year of the Montreal Tramways Company ends on June 30th, we are already in receipt of the printed report for the past year. The gross earnings were $6,525,231, a decrease of $617,572, or approximately 8.65 per cent. The net earnings after deducting operating expenses this year amounted to $2,811,235, an amount less than the previous year by 4.27 per cent. The ratio of operating expense to earnings is 56.92 per cent. this year as compared with 58.89 per cent. last year. The report states that "in accordance with the desire of the city of Montreal to remove as far as possible the overhead wires on the city streets, the company is now proceeding at considerable expense to place its overhead feeder wires in the municipal conduits which have so far been provided for that purpose." Regarding the future of the company the report has this to say: "Keeping in view the future growth of the city the company has been working on a plan to re-arrange the power distribution in order to make the power supply from the different stations interchangeable. This will take time to complete but will place the company in a better position to handle the future traffic of the city." The property of the company has been maintained in a high state of efficiency, the sum of $666,429 having been expended in maintenance.

Contract for La Loutre Dam

The contract for the construction of La Loutre Dam, on the St. Maurice River, 52 miles from the mouth of the Manouan River, P.Q., has been let to the St. Maurice Construction Company, Limited, of which Mr. Julian C. Smith, of the Shawinigan & Cedars Rapids Companies, is president. The price is $1,425,000. The dam will be of great benefit to the hydro power companies and plants on the St. Maurice River, and the Quebec Government, who have undertaken the enterprise, are assured of sufficient annual income, from the companies having plants, to more than pay for the maintenance charges and interest on the capital cost. The storage proposed will increase the power at Shawinigan over the low water year of 1906 by 32,000 horse power years, and will double the low water possibilities of the St. Maurice River at that point.

Beauharnois Installing Lights

The town of Beauharnois, P.Q., is carrying out a system of public lighting, installing 160 lights over a distance of about four miles. The lights are to be 100 candle-power nitrogen-filled tungsten lamps, mounted on wooden poles 30 feet high. Wheeler-Mazda brackets, supplied by the Canadian General Electric Company, are to be used. Current will be purchased from the Montreal Public Service Corporation, at 2200 volts, constant current transformer being installed. The present steam equipment for pumping water is being replaced by an electric pump of the Rees-Roturbo type, supplied by Heap and Partners, Montreal. The plans and specifications were all prepared by Mr. W. G. H. Cam, of Montreal, who is also superintending the work.

The Dealer and Contractor

Value of Local Associations

Electrical contractors, as a rule, believe that they are doing business under extremely bad conditions, and that the bids of their competitors are the most eratic to be found in any class of business. The man who can guess within 50 per cent. of what his competitor's bid will be on any proposed work, is endowed with some uncanny sense which puts him in a class by himself, when it comes to the guessing game.

I will not try to disprove this statement. We will admit that these things are so close to the truth, that a man with a vivid imagination might easily believe this is a true condition. The question naturally arises, "Whose fault is it if conditions in the electrical contracting business are in such a state? Why is it that these conditions do prevail?"

My belief is that the fault mainly lies with the men who are engaged in the business; that most of the obstacles in the way of the electrical contractor are merely surface obstacles, some of them placed there himself, and practically all of them may be overcome by concerted effort.

We often look away into the distance, and view the apparent successes which have been made by other men in other lines of business, and to think that if we were only engaged in that particular line of business, or located in that particular place, things would "come our way."

The perspective we get is not always a true one. When we get near enough to the coveted business, we will probably find there are many mud holes and quagmires through which that man has had to travel, and that in all probability he is a battle scarred veteran, has received upper cuts and body blows, and who knows, he may be looking longingly at the Electrical contractor, thinking that if he only had a business like that, how peaceful and profitable his life would be. Do not forget that "distance lends enchantment to the view."

Don't "over"-look opportunities

Is it not possible that the Electrical Contractor is spending too much time in bemoaning the conditions which exist in the Electrical business, and looking longingly at some other fellow's business, and overlooking the opportunities which may lie right at his feet. I remember seeing somewhere, a long time ago, two pictures which I have never forgotton. One was of two cows, each in her own pasture, and one had her head through the fence eating the grass out of the other pasture, and the other cow had her head through the fence eating the grass in the pasture, not her own. The other was a companion piece. Two men were sitting on the opposite banks of a stream, which was apparently about 40 ft. in width, and each had his line thrown full across and was fishing close to where the other fellow was sitting. The question was, "Why is the grass sweeter on the other side of the fence and why the fishing better on the other side of the stream?" "Distance lends enchantment to the view."

I remember well, a little incident in my own career. I was fishing along the Elk River in Kansas. I had caught several nice bass, and a couple of channel cat fish, and in fact I had a nice string. I noticed, however, a place almost directly across the river from me, where there appeared to be an eddy around some willows, and it looked like the place ought to be alive with bass. The enchantment was too much for me, and I picked up my tackle and string of fish, and made my way through the underbrush, up the river about half a mile to a place where I could ford the river. I waded in, and when about half way across, the string broke and every fish I had, got away. There was nothing left for me to do but go on across the river and back down to that lovely place where all those bass were waiting for me. When I got there, I found that the bank was so muddy that I could hardly get down to the water, and when I did get located, I found that the place was shallow and full of snags, and I didn't get a strike. I looked back to the place from whence I came, and wondered how I could have been foolish enough to have left it.

What I am trying to show, is that it is an easy matter to overlook the opportunities which are right at our feet, and to imagine that somewhere there is a place where success will come without effort; where customers will always be eager to buy; where central stations will meet us with open arms, and where the general contractor will cease from troubling. Some of you, no doubt, have heard Russell Conwell in his lecture on "Acres of Diamonds." A farmer owned land which was not very productive. He struggled hard to make it pay. One day a travelling priest came that way, and stopped at the farmer's house over night. He related a story of a recent discovery of diamonds. Men were finding diamonds and were getting rich in a day. After the priest had gone, the farmer came to the conclusion that he was foolish to stay at the barren farm, when he also might be picking up diamonds, and become independent. He sold his farm and went in search of the diamond fields. The man who purchased his farm, was down at the spring one day, dipping up some water, when he noticed a peculiar looking pebble at the bottom of the spring. He dipped it up and it proved to be a diamond of great value. Other diamonds were found on the same farm and the owner became wealthy. The previous owner had left the farm in search of the very thing which lay almost under his feet, and which he had probably seen a hundred times and not recognized.

More work right at hand

These stories are told, believing that if the Electrical Contractor will look closer about him, he will discover that there is something more in the electrical business than he has found. That most of the obstacles about him are surface obstacles, and that if he would go a little deeper, even some of these obstacles might prove to be blessings in disguise.

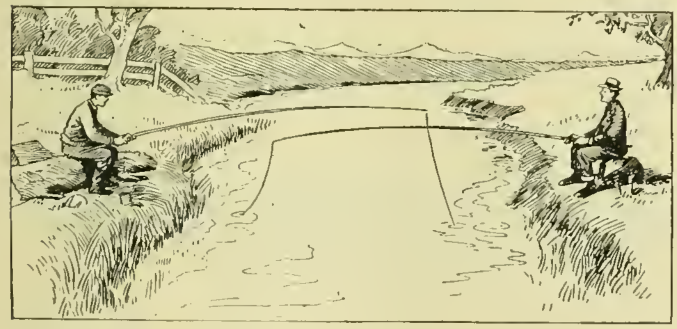
*By C. A. Walker in National Electrical Contractor

It may be that about the time some of the Electrical Contractors get discouraged and sell out to go to Canada or to some other promising field, some fellow will step into your place, find out that most of the things you have been kicking about are chargeable to the contractor himself; that the contractor had been going on the theory that his business should be his business and that all others were usurpers and should be driven out, whereas the real facts are that each Contractor is only one cog in the wheel of a mighty big machine, and that if that machine ever gets going, these things which are causing so much uneasiness, will gradually fade away. He will probably call on his neighbor-contractor and find out that he is a pretty good fellow. They will talk matters over. They will compare notes and will find that it costs the Contractor about 40 per cent. to do business, they will talk over other matters and will each learn something from the other.

Get acquainted

He will make the acquaintance of the other Electric Contractors and eventually will perfect a local organization. At the very first meeting they might find that some general contractor, with a genial smile had been double crossing them. Each had thought that he was the General Contractor's particular friend, and that if it had not been for the low prices that Smith or some other fellow had made, they would have had all of the work.

Some General Contractors have no use for Associations. They can't use them to advantage. Now that there is an Association, and the contractors are on speaking terms, someone might say that Mr. Merchant, a public spirited gentleman, where some of the members traded, always had a "Curbstoner" do his work, because he could save a little money, perhaps. Mr. Merchant realized that the "Curbstoner" had little expense, paid no taxes, used no



Distant pastures look greener

stationery, employed no labor, burned no light, whereas those other fellows were under heavy overhead expense, maintaining places of business and trying to make them attractive. This association might now organize another one and invite Mr. Merchant to become a charter member. They might go to Mr. Merchant and explain that they were organizing the "Economical League" and unfold the plan. All of their groceries, shoes, clothing, stationery, carpets, rugs, furniture, etc., they were going to purchase from Jeers & Sawbuck Co., a mail order house. All of their lumber, paints, oils, hardware, etc., they would buy of the "Order and Cash-at-the-same Co." They were making arrangements to buy coal direct from the mine at wholesale prices, and were negotiating with the telephone company to connect with a phonograph for an hour each Sunday so that the preaching would be less expensive. If a program of this kind could be carried out, living would be less expensive. They could get along without paving, the sidewalks would last longer, for they would not be used so much and that taking it all in all it would be much more economical than the way they were doing. What would Mr. Merchant say? He might say, "Boys, that would ruin my business." Then would come the deadly parallel. Mr. Merchant would probably wake up and in the future would patronize some one of the contractors.

Contractor, Jobber, Central Station

When Electrical Contractors can lose sight of their own business, that which is contained within their own walls, and realize that the general conditions under which they are doing business are either a liability or an asset, as they are made, it will be possible as an association to go to the Central Station or to the Jobber and to get, as a matter of fairness, such consideration as the contractor has a right to expect. Local conditions require local treatment, and the local association can be on hand at the time the treatment is required. On the broader questions, such as legislation, and those things which affect the contractor in a general way, the state and National associations stand ready to bring the entire force into action, and when this great machine comes into its own, things will be done which no one contractor would dare attempt. As long as men in the same lines of business have no intimate connection, just so long they may expect to be victims of persons who take advantage of the discords which arise from their disorganized conditions.

Get together and work for the general good of the business you are engaged in. Discover the diamonds which are lying at your feet. Catch the fish that are on your own side of the stream, and learn that the grass is just as sweet on your own side of the fence.

Jovian League Picnic

The fifth annual picnic of the Winnipeg Jovians was held at Selkirk, July 31st, 1915. In spite of the threatening weather over one hundred members and their friends attended, and all thoroughly enjoyed the day. Many of the old-timers were present, including W. H. Reynolds, P. O. 4388, Cadmus, Past Statesman L. H. Dickson, No. 4724, Statesman at Large F. E. Filer, No. 3591, Statesman R. H. Mainer, No. 4735, Second Tribune J. H. Schumacher, No. 4742, President of Winnipeg Jovian League W. H. Billing, No. 5054, Vice-president J. S. Madden, No. 4734, Sec-treas. W. E. Skinner, No. 4747, Executive Committeemen Thos. Carlysle No. 5655 and J. S. Henry No. 5994 and many other of the members of the organization.

Various sports, including a baseball game, were held in the afternoon, the prize list being an attractive one. At 5.30 a sumptuous repast was spread on the tables under the trees, and a hungrier, happier bunch would have been hard to find.

Great credit is due the Winnipeg, Lake Winnipeg and Selkirk Railway Company for the satisfactory transportation facilities afforded and the courteous treatment by their employees of the members of the Jovian Order and their friends. The executive and members also wish especially to express their appreciation of the kindness of the following who made the prize list possible: Northern Electric Co., Canadian Westinghouse Co., Canadian Maloney Co., Mainer Electric Co., McDonald & Willson Lighting Co., Schumacher Gray Co., Canadian Johns-Manville Co., Laco-Phillips Co., Ferranti Electric Co., Standard Underground & Cable Co., Canada Wire & Cable Co., George Guy, Canadian Fairbanks Co., Canadian General Electric Co., and the Eugene Phillips Electric Works.

915—**Aluminum.**—A Liverpool firm who are large buyers of granulated aluminum and also ingot and bar aluminum wish to get into touch with Canadian firms who can supply same.

Canada Sales Company Agencies

The Canada Sales Company, 166 Bay Street, Toronto, announce that they have been appointed factory representatives for the Import Sales Company, New York, for a new line of metal tubular cases for flashlights which they have just placed on the market. Other agencies carried by the Canada Sales Company include that of the Vosburgh Company, West Orange, N. J., manufacturers of a high grade of nitrogen filled automobile lamps ranging from 6 to 24 volts and from 6 to 75 candlepower. They are also Canadian representatives for Gillinder Bros., Port Jervis, N. Y., and are showing a complete line of bowls, lanterns, urns and shades in a wide variety of finishes, shapes and prices. The Canada Sales Company have also recently taken the agency of the Trumbull-Vanderpoel Electric Company of Bantam, Conn., manufacturers of knife switches, panelboards and enclosed fuses.

Well Known Supply House Loses Head

The many friends of Mr. C. H. Basters have learned with deep regret of his death by drowning on Tuesday, August 3rd. Mr. Basters was the president and senior partner of C. H. Basters & Co., the well-known electrical supply house at 22 College Street, Toronto. On that fateful day he, with his wife and a number of friends, was caught in a dinghy on Lake Ontario by the terrific storm which centered around Toronto. Apparently Mr. Basters was making heroic efforts to control his boat and was either swept away or fell exhausted from the deck. The remainder of the party was landed safely. The sympathy of the Electrical News and of Mr. Basters' many friends among our readers goes out to his widow in her affliction.

Another Canadian Beauty

The Renfrew Electric Manufacturing Company, Limited, Renfrew, Ont., are distributing a useful little booklet entitled "Canadian Beauty Hand Book," which contains a quantity of useful information for dealers and salesmen in electrical appliance stores. Too often an electrical appliance fails to give satisfaction because the salesmen in making the sale over-estimated its possibilities or made unreasonable statements concerning it. This little booklet offers an opportunity to become acquainted with electrical terms and their meaning, together with their proper relation to electric heating appliances. We understand it can be had for the asking and we hope that every dealer and contractor will see that every man in his employ is supplied with a copy. The company advises that the first supply is already exhausted but that additional copies will be available immediately.

Have You Made Your Plans for the Convention?

Now that you have made your plans to take in the convention of electrical contractors which is to be held in Toronto on September 6th, 7th and 8th, you will be anxious to know what the program is going to be like. The committee having this matter in charge have been very active during the past fortnight and, as a result, we are able to print below a tentative outline of the proceedings, which promises well in interesting material and valuable discussion.

One of the most importatnt items, however, does not appear on the printed program, viz., the opportunity that electrical contractors will have of "getting together" so that some of the corners of their little misunderstandings may be rubbed and rounded off and a better system of cooperation set in motion. We understand too that a "get acquainted" luncheon will probably be one of the prominent features.

Any electrical contractor who has not yet made his plans to profit by this convention is urged to do so—**now.** The National Electrical Contractors' Association of the United States have just been having their convention 'way out in San Francisco and everybody has come home saying how much "information" and "new business ideas" they gathered in. That's the kind we are going to have in Toronto and for the good of the profession we want every contractor to share in this exchange of gray matter.

Proposed order of business for Convention to be held in Association Rooms, 2 College Street, Toronto, Ont., commencing Monday, September 6th, is given herewith as determined to date.

Monday, September 6th.

10 a.m. to 2.30 p.m. Registration of Delegates.

1. Address of Welcome.—Toronto Civic Official. Opening of Convention.—The Chairman.
2. Address on Organization and its merits, with particular reference to our Organization.—Mr. E. A. Drury, Toronto.
3. Licensing of Electrical Contractors. What other cities have got, and how we should work towards getting the License.—Speaker to be selected.
4. "Do it Electrically." An address on Electrical Development.—Mr. Walter Carr.
5. Rules and Regulations of the Hydro-Electric Power Commission of Ontario.—Mr. H. F. Strickland.
6. Proper Accounting System for Electrical Dealers and Contractors.—Speaker to be selected.
7. Workmen's Compensation Act of Ontario as it affects Electrical Contractors. Mr. E. M. Trowern.
8. The Possibilities of Advertising in the Electrical Business.—Mr. Frank H. Rowe.
9. The relation of the trade newspaper to the electrical trade and to the Association.—Mr. J. C. Armer.
10. The relation of the Jobber to the Dealer and Contractor, and the Jobbers' function in the trade.—Speaker to be selected by the Jobbers' Section of the Board of Trade, Toronto.
11. The Re-sale Problem. Report from Committee formed to try and secure a fair scale of Re-sale prices from jobbers.—Mr. G. T. Dale.
12. Competition from Power Companies and Municipalities. —Mr. Geo. W. Hill.
13. General Discussion and Suggestions, and submitting of Motions by delegates for consideration.
    (a) Consideration of the advisability of establishing a Provincial Organization. (1) Consideration of Membership Fee. (2) Election of Provincial Officers.
    (b) Making this Convention an Annual affair. (1) Appropriation for Convention Expenses for next year—this year's expenses being already provided for. (2) Setting date and place for 1916 Convention.

And any other subjects that any Dealer or Contractor desires to submit.

What is New in Electrical Equipment

Fargo Electrical Connectors

We illustrate herewith a number of the latest designs of electrical connections manufactured by the Fargo Manufacturing Company, Poughkeepsie, N. Y. These new devices have electric wiring of all kinds whether for transmission purposes, electric lighting, power or electric railway service.

Fig. 1 will give a general idea of the principle under-

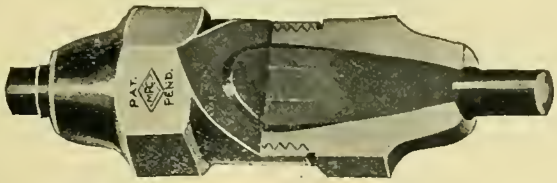


Fig. 1.

lying all of these devices. This represents a straight type connection. It is constructed of four parts, two inner cone-shaped copper cylinders and two outer connector pieces which thread together, clamping the cones firmly against the cable and forcing the ends of the cable together so as to form a cold weld. These joints are of low resistence and

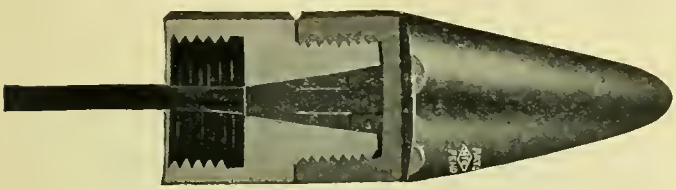


Fig. 2.

the manufacturers claim the efficiency of a joint connection is increased by 50 per cent.

Fig. 2 illustrates a type of ground cone. The Fargo grounding devices have eliminated the use of bolts and nuts which soon become loose and render the grounds a source of danger. The device shown in Fig. 2 is easily installed and

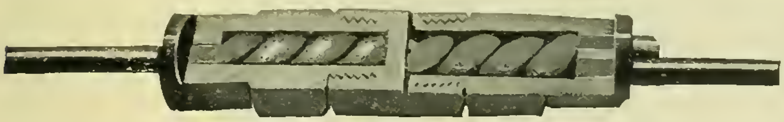


Fig. 3.

is claimed to be as nearly a perfect ground as it is possible to get. The wires are locked together forming a bond of high conductivity.

Fig. 3 shows another form of straight connecting device consisting of three outer connecting pieces without

Fig. 4.

cones. As the nuts are tightened the wire is twisted forming an airtight and practically solid connection.

Fig. 4 shows a transmission line connector. This is practically a combination of the two connectors as shown in Fig. 1. It insures that two grips are taken on each wire and the manufacturers guarantee that with this connector the cable will pull apart before the connector will let go of it. Indeed this is claimed for any of the connectors.

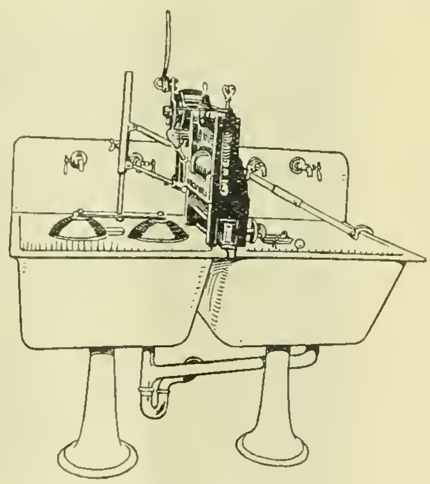
Other devices include cable locks, terminal connections, Y connections, L connections, T connections, groundclamps, cable grips, guy grips, guy terminals, bus-bar connections, etc., all manufactured on the same continuous joint principle.

Exhibit of Protecting Devices

There is being exhibited at the American Museum of Safety, 18 West 24th Street, New York, an historical exhibit of central station electrical protecting devices. During the next two weeks this exhibit will occupy the window space of the museum and thereafter it will be located in the museum as a permanent exhibit. This exhibit should be of interest to the general public in that it represents the progress made in the electrical art with special regard to the service equipments that are installed by central stations in almost every house where electricity is in use. The display lays special emphasis on the safe-guarding of life and property. This exhibit was arranged by the Metropolitan Engineering Company at the request of the museum authorities.

Stationary-tub Washer

An electric washing machine, known as "The Stationary-tub Electric Washer"—embodying many new and radically different features, has been developed by the Kelman Electric & Mfg. Co., Los Angeles, Cal., and is now being placed on the market. This machine washes, wrings, rinses, and blues in any stationary tub, and eliminates all handling of water by the operator—the plumbing fills and empties the tub for her. Being mounted on the stationary tub, the machine is entirely out of the way; yet it is always ready for use, and avoids all "getting ready" and putting away." The operation is extremely simple—one operating handle, by a slight movement one way or the other, governs the action of the wringer or washer. To reverse the wringer, the motor is reversed by means of an ingenuous four-point attactment plug. This reversing it electrically instead of mechanically, eliminates the complicated gearing otherwise



Eliminates all handling of water

required. Safety of operation is provided for by enclosing the mechanism; by a safety pressure-release on the wringer, whereby pressure can be instantly removed from the wringer rolls; and by the four-point attachment plug, which can be quickly detached, stopping the washer or wringer immediately. By loosening a thumbscrew, the motor may be removed for other purposes. Simple accessories facilitate its use as a sewing-machine motor, or to operate small grinding or buffing wheels, and save the cost of thee additional motors usually required with such apparatus.

Underground Conduit Exhibition

Among the Canadian exhibitors at the Panama Pacific Exposition at San Francisco is G. M. Gest, Limited of Montreal, Winnipeg and Vancouver. This exhibit while interesting to all, is instructive as well, and has attracted widespread interest, not only among those in electrical work, but also in everyone devoted to civic welfare. It has been the hue and cry in many cities to remove all overhead wires, and in this exhibit everything is shown pertaining to the underground which takes the place of the unsightly overhead.

Mr. Gest has made a specialty of underground conduit construction for many years, and has been identified with many of the largest installations of conduit and ornamental street lighting in Canada. In addition to the construction, Mr. Gest has done considerable engineering throughout Canada. Quebec, Montreal, Toronto, Ottawa, Winnipeg, Vancouver and Niagara Falls, have all benefitted by having this class of work installed by his organization. In most of these cities this organization has not only completed contracts for corporations, but for municipalities as well.

In recognition of what Mr. Gest has done in developing conduit systems, and for his methods of installation, the International Jury of Awards at the Exposition, has awarded his organization a gold medal, the highest award in his class. The exhibit, occupying about nine hundred square feet in the Palace of Machinery, comprises systems of underground conduit and cable construction, and shows the different materials, apparatus and methods of construction of the underground conduit and cable systems, and distribution systems wherein armoured cable is used. Everything for the distribution of electrical energy—light and power, signalling and communication—are presented in an attractive form. The various methods of installing underground conduit for draw-in systems are shown, including fibre, pump log, (creosoted wood) iron pipe, and clay conduit in both single and multiple, square and round bore type. Also methods employed in Europe including that known as the "trough system," using cast iron, asphalt and tile trough. Of the solid systems are shown armoured cable laid direct in the ground, also the Edison tube system.

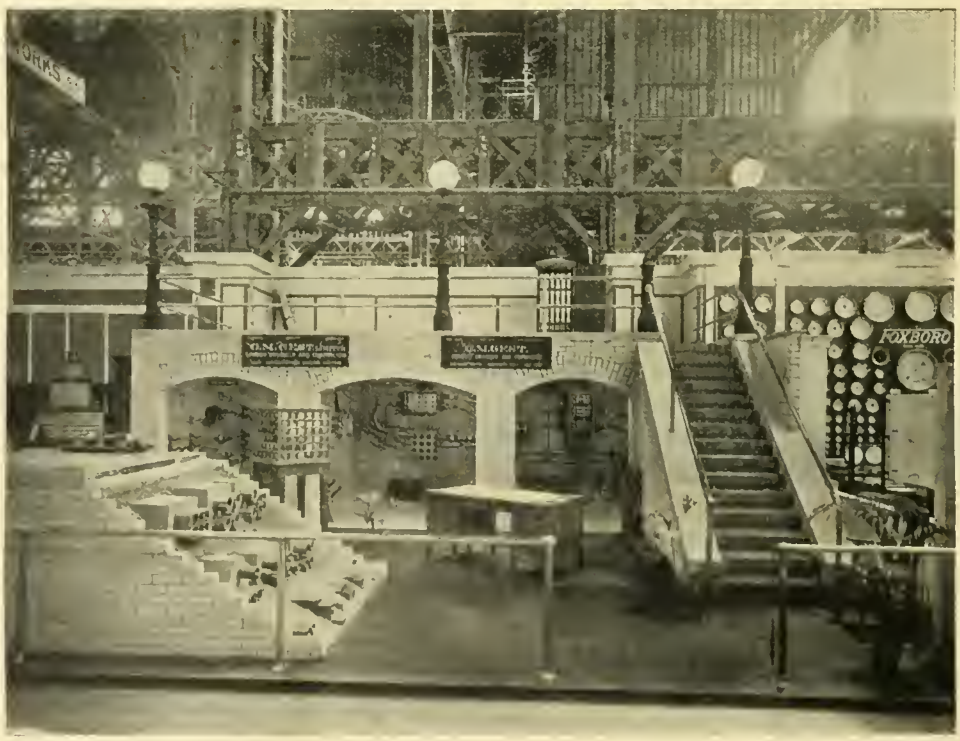
Manholes are represented in telephone, light and power, also the transformer vault; these are in brick and concrete construction. Shown complete are the various forms of apparatus for the proper distribution of electrical energy for the several systems, such as transformers, junction boxes, cutouts, switches and cable terminals, all technically installed. In addition to the cable and other apparatus installed in the manholes are shown a street pillar and kiosk, also an ornamental lighting system with method of feeding, by means of underground distribution systems.

Augmenting the practical side of the installation of underground work described, drawings are shown of the plans for complete underground systems, also a collection of lantern slides, showing special features of construction, also lighting systems in various parts of this continent and Europe. As an exhibit, it is very interesting and instructive to all.

The Brantford township has closed an agreement with the Brantford Hydro-electric Commission for a number of roadway lights which will cost from $10 to $12 each per annum. Houses along the way will be supplied with electric light from the same lines; the rates to be the same as in the city.

Electrical Men Give Machine Guns

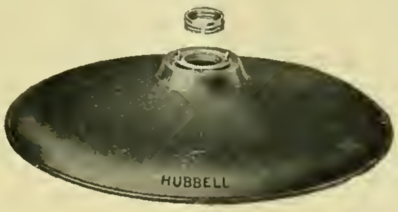
The chief officers of the Montreal Light, Heat and Power Company have made contributions of machine guns for the Canadian troops; Mr. J. S. Norris, the general manager, Mr. R. M. Wilson, chief electrical engineer, and the heads of the departments, have each contributed a gun. The employees of the Northern Electric Company, Limited, have purchased two guns.



San Francisco Exhibit of G. M. Gest Limited.

New Enamel Reflector

The illustration herewith represents a new 14-in. type porcelain enameled steel reflector being placed on the market by Harvey Hubbell, Inc., Bridgeport, Conn. This is par-



ticularly designed for use with 60 watt short base tungsten lamps, the neck being so designed that when the lamp is inserted in the socket the filament is in the proper position to secure the maximum diffusion of light.

Cordless Type Vestibule Outfit

The Connecticut Telephone & Electric Company, Meriden, Conn., have just placed upon the market a new vestibule telephone outfit known as their cordless type. As will be noted from the illustration this telephone has a concealed transmitter and receiver—to operate it is simply necessary to push the button and talk facing the vestibule telephone

just as if in conversation with your party in front of you. The person talking from the suite can be heard for a long distance from the vestibule telephone, due to a specially constructed loud talking receiver. There is nothing on the face plate except the card holders and buttons. Therefore there are no cords or receivers to be stolen, no hooks to be broken.

7½ watt, 5 c.p. tungsten lamp

The Edison Lamp Works of the General Electric Company announce the development of a 7½ watt, 105-125 volt mazda sign lamp. Specifications state that the candle power is 5 and the life 2,000 hours.

Radio Electric Company in Larger Quarters

The Radio Electric Co. of Canada, Ltd., manufacturers of wireless apparatus and electric elevators, Stigler type, have moved their offices and factory to larger and more suitable quarters at 122 Vitre St. West, Montreal. Among the recent orders filled by the company were wireless field sets, with steel masts, for the Royal Canadian Engineers.

Recent Publications

The "Rapid" Transmission-Line Chart, published by The Moore Printery, Hamilton, Canada, cardboard, 11 by 8 inches. Price 50 cents.

Personal

Mr. W. A. Bucke, manager Toronto District Office, Canadian General Electric Company, was married on August 5th to Margaret Eleanor Davis, Toronto.

Mr. J. Singleton, former electrical inspector of Prince Albert, Sask., has left to join the third University Corps, which will be used to reinforce the Princess Patricias.

Mr. A. S. McAllister, Ph.D., has resigned as editor of the Electrical World and severed his connection with the McGraw Publishing Company on August 1st.

Mr. R. F. Pack, Minneapolis, former manager of the Toronto Electric Light Company, has been elected a member of the Executive Committee of the National Electric Light Association.

Mr. N. C. Pilcher, general manager, Sherbrooke Railway & Power Company, Sherbrooke, Que., is captain of the 5th Mounted Rifles and is proceeding to the front with the Canadian Overseas Expeditionary Forces.

Mr. E. J. Craigen, who has been associated for the past five years with the Canadian General Electric Company, the last three years as erecting engineer in the Calgary district, left last month for Great Britain, where he will be engaged as an electrical engineer.

Mr. R. H. Parsons, superintendent of the municipal power plant at Edmonton, Alta., has tendered his resignation to the commissioners. Mr. Parsons has returned to Manchester, Eng., where he will be connected with a large factory engaged in the manufacture of the munitions of war.

Mr. H. F. Strickland, chief electrical inspector Hydro-Electric Power Commission of Ontario, was recently operated upon in St. Michael's Hospital for appendicitis. His many friends will be glad to know that everything is going along nicely and that he will be back in harness in a few days.

Mr. W. M. Wasser, manager of the B. C. Telephone Company at Nanaimo, has been transferred to North Vancouver as manager. Mr. J. S. Menzies, of North Vancouver, has been transferred to head office. Mr. J. W. Sowerby, of Duncan, succeeds Mr. Wasser in Nanaimo and Mr. J. Davis, of Milner, succeeds Mr. Sowerby in Duncan.

Mr. W. P. Cochran, formerly branch manager of the Westinghouse Electric & Mfg. Company at Baltimore, has been appointed Assistant District Manager of the Philadelphia district including Baltimore, and will make his headquarters in the former city. Mr. M. H. Jones, Assistant to Manager, will have charge of the Baltimore branch office.

Mr. W. J. Doherty has resigned the position of general sales manager of the Northern Electric Company, Limited, Montreal, to go into business in Chicago. At a dinner, held at the Engineers' Club on July 30, he was presented with a loving cup and an illustrated address by a number of business friends. Mr. W. H. Winter, of the Bell Telephone Company, presided, and speeches were made by Messrs. Paul F. Sise, managing-director of the Northern Electric, R. Hiller, R. Smith, P. T. Davies, C. Ellis and J. Lachapelle.

The Northern Electric Company, Limited, obtained the contract for supplying the city of Montreal with the necessary cable, etc., in connection with an electrical conduit system for the filtration plant. It is reported that the price was slightly higher than that of a competitor, but that the Board of Control decided to give the contract to the Northern Electric on the ground that it was their duty to employ local labor.

The Keyes Supply Company, Limited, Ottawa, Ont., has been incorporated with capital stock of $15,000.

Current News and Notes

Brockville, Ont.

Work is in progress on the installation of an electric lighting system in the township of Elizabethtown. Power will be supplied from the Brockville sub-station and the work is being carried out under the direction of the Brockville Electric Commission.

Chatham, N.B.

The town council recently amended the electric light by-law by the following addition: "A verandah, porch, lawn, or outside electric light, installed by a customer at a point within the distance of thirty feet from a main street with the approval and under the direction of the Town Superintendent and so placed as to light an adjacent portion of the said street, will be entitled to a rebate of three dollars at the end of the year or pro rata for portion thereof, provided that the said customer's consumption of electric light is not less than fifteen dollars per year."

Carlyle, Sask.

A by-law was submitted on August 9th authorizing an expenditure of $3,000 for the purpose of completing the electric plant.

Durham, Ont.

The town council have made an arrangement that the manager of the local furniture company to supply them with electric energy until such time as the local distribution company is connected up with the Niagara lines.

Exeter, Ont.

A by-law was carried on July 25 authorizing expenditure of $20,000 on a Hydro distributing system.

Harriston, Ont.

The enabling by-law as well as the by-law authorizing the council to raise the money necessary to install a Hydro distribution system was carried on July 25 by a considerable majority.

Hamilton, Ont.

The annual picnic of the employees of the Dominion Power & Transmission Company was held at Grimsby Beach on July 23 and was one of the most enjoyable in the history of the company.

Holstein, Ont.

Egremont township will shortly submit a by-law authorizing the necessary expenditure for an electric distributing system.

Listowel, Ont.

A by-law will be submitted on August 21 authorizing an expenditure of $6,600 on a distribution system to be linked up with the other lines of the hydro-electric system in Ontario.

Milverton, Ont.

A by-law was carried on July 30th authorizing the necessary expenditure in connection with a hydro-electric distributing station.

Montreal, P.Q.

Mr. H. B. Van Every has been appointed Canadian representative of the S. Morgan Smith Company, of York, Pa., manufacturers of hydraulic turbines and accessories. The Canadian office is in the Power Building, Montreal.

Mount Forest, Sask.

The Mount Forest Rural Telephone Company are contemplating an extension of approximately 40 miles to their line. The estimated expenditure is $11,000.

Nelson, B.C.

Thomas C. Cummins, manager of the Cascade plant of the West Kootenay Power and Light Company was killed by lightning on July 30th. Mr. Cummins was born in Grenfell, Sask.

Newmarket, Ont.

On August 1st the new rates for light and power came into effect. This follows the completion of the work linking up the system with the Toronto and York Radial lines. Arrangements have also been made for pumping water for the town by electric motor.

Ottawa, Ont.

A chain of wireless stations is to be erected along the proposed steamer route in Hudson Bay. Preliminary work is commencing at once and it is said that a steamer has already left Halifax with a load of building material and a gang of construction men.

Palmerston, Ont .

An enabling by-law was recently passed authorizing an agreement with the Hydro-electric Power Commission of Ontario. The vote stood 203 to 12.

Petrolea, Ont.

A by-law was recently carried in Petrolea, Ont., by a majority of 385 to 10 authorizing the expenditure of $35,000 on an electrical distributing system. The town has an estimated price from the Commission for 500 h.p. at $36.25 per horsepower.

Rockton, Ont.

Beverly Township recently passed a by-law authorizing an expenditure of $4,500 on a hydro-electric distributing station.

Renfrew, Ont.

The new White Way on which installation work is practically completed in Renfrew, Ont., was officially turned on on August 11.

Rosetown, Sask.

The Rosetown Electric Light & Power Company, Limited, has been incorporated in Rosetown, Sask.

Sherbrooke, Que.

The electric committee of the city council have recommended the purchase of a one thousand pound electrical truck from the Andover Motor Vehicle Company.

Sudbury, Ont.

Work is proceeding rapidly on the Sudbury and Copper Cliff Suburban Electric Railway Company's line between here and Copper Cliff. A quantity of steel has been laid and it is confidently expected the line will be in operation by October 1.

Southampton, Ont.

A by-law was submitted on August 4 authorizing expenditure of $13,000 for a hydro distributing system.

Tavistock, Ont.

The city council have purchased the local electric system from Mr. J. G. Field at a cost of $3,650.

Toronto, Ont.

The Toronto Hydro-electric Commission are asking the city council for an additional $1,375,000 to cover necessary extensions to the distribution system.

Construction work has begun on the new civic car line extension on Lansdowne Avenue, Earlscourt.

Equipment for Australian Railways

Tender forms, specifications, indents and drawings have been forwarded by Mr. D. H. Ross, Trade Commissioner at Melbourne, for equipment required by the Victorian and New South Wales Railways. These tender forms, etc., are open to the inspection of interested Canadian manufacturers at the Department of Trade and Commerce, Ottawa. Particulars of the requirements, together with the date on which the tenders close at Melbourne, are briefly outlined thus:—

Victorian Railways

No. 28,918—Sept. 8—Transformers and relays for point indication for automatic signalling (5 years supplies).

No. 28,951—Sept. 8—Electric point and lock detectors (5 years supplies) (as per drawings).

No. 29,067—Sept. 15—20,000 mantles (700 C.P.) for Lux lamps.

No. 28,350—Sept. 29—1 combined chain cutter and hollow chisel mortising and boring machine.

No. 29,004—Sept. 29—1 Batch concrete mixer with patrol motor and accessories.

No. 29,080—Sept. 29—5,000 fuse blocks (as per drawing).

No. 29,080—Sept. 29—5,000 spare porcelain bases.

No. 29,080—Sept. 29—10,000 spare fuse clips.

No. 29,012—Oct. 13—5,800 Imperial gallons lubricating oils.

No. 29,012—Oct. 13—3 tons lubricating grease for electrical equipment.

No. 29,102—Oct. 6—574 yards Saxony Brussels carpets.

No. 29,102—Oct. 6—6 Victorian Axminster carpets.

No. 29,113—Oct. 6—Two 12-inch Gap lathes, tools and accessories.

No. 29,130—Oct. 6—20 "V" double-side tipping wagons.

The departure of mails from San Francisco and Vancouver are indicated thus: —From San Francisco, August 1; due Melbourne, September 21. From Vancouver, September 1; due Melbourne, September 25.

Lighting Schedule September, 1915

Courtesy of the National Carbon Company Cleveland

Date	Light	Date	Extinguish	No. of Hours
Aug 1	7 00	Aug 1	11 50	4 50
2	7 00	3	0 40	5 40
3	7 00	4	1 40	6 40
4	7 00	5	2 40	7 40
5	6 50	6	3 50	9 00
6	6 50	7	4 50	10 00
7	6 50	8	4 50	10 00
8	6 50	9	4 50	10 00
9	6 50	10	4 50	10 00
10	6 50	11	4 50	10 00
11	6 40	12	4 50	10 10
12	6 40	13	4 50	10 10
13	6 40	14	4 50	10 10
14	6 40	15	5 00	10 20
15	6 40	16	5 00	10 20
16	6 40	17	5 00	10 20
17	10 40	18	5 00	6 20
18	11 50	19	5 00	5 10
20	1 10	20	5 00	3 50
21	2 20	21	5 00	2 40
22	No Light	22	No Light	
23	No Light	23	No Light	
24	No Light	24	No Light	
25	No Light	25	No Light	
26	6 20	26	8 30	2 10
27	6 20	27	9 10	2 50
28	6 20	28	9 50	3 30
29	6 10	29	10 40	4 30
30	6 10	30	11 30	5 20

Total Hours............181.40

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ADVERTISEMENTS

Orders for advertising should reach the office of publication not later than the 5th and 20th of the month. Changes in advertisements will be made whenever desired, without cost to the adveitiser.

SUBSCRIBERS

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Vol. 24 Toronto, September 1, 1915 No. 17

Unfavorable Report on Electrification

Railway officials all over the continent have been eagerly watching for the report on the electrification of the Chicago terminals which has been the subject of investigation by a committee of railway engineers for many months. The Electric Railway Journal prints the following item in its latest issue:—

Newspaper dispatches from Washington, D.C., purporting to contain authentic information taken from the forthcoming report of the smoke abatement and electrification of railway terminals committee of the Chicago Association of Commerce state that the committee has decided that the electrification of Chicago's terminals is impractical and impossible to finance. The proposed electrified zone contains 4,501 miles of track, of which 2,819 miles are within the city limits. Some of the items of expense included in the estimates for electrification are 1,600 locomotives at $40,000 each, and several power houses having a total capacity of from 1,000,000 to 1,500,000 kw. and costing $100 per kilowatt. These, with the cost of the propulsion current conductors and changes in the existing property, make the total estimated cost $280,000,000. It is also said that the reports convey the impression that the fixed charges on this large investment would cripple some of the railroads beyond recovery. The report also attempts to show that electrification in Chicago is much more intricate than in other cities where such work has been done.

Another portion of the report devoted to the question of smoke pollution is said to contain the following figures: Percentage of the total fuel consumed within the city limits of Chicago: by steam locomotives, 11.9 per cent.; by all other services, 88.06 per cent. Percentage of the total visibility of smoke emitted within the city limits of Chicago: by steam locomotives, 22.06 per cent.; by all other services, 77.94 per cent. Percentage of total solid constituents of smoke emitted within the city limits: by steam locomotives, 7.47 per cent.; by all other services, 92.53 per cent. Percentage of the total cases of combustion in smoke emitted within the city limits: by steam locomotives, 10.31 per cent.; by all other services, 89.69 per cent.

From the foregoing information the committee is said to conclude that air pollution so far as it is affected by the smoke of railroad locomotives is not injurious to the city's health. While there is reason to believe that this information is correct, it was impossible to obtain a confirmation at the committee headquarters, in Chicago. The statement was made there that the first abstract of the report will be given to the press on or about September 15, 1915.

Good Work of Quebec Streams Commission

Tenders are being called by the Quebec Streams Commission for the construction of a dam on the St. Francis River, P.Q., for the storage of water from a drainage area of 472 square miles, with a view to increasing the water power on the river during low water periods. This storage will add 6,000 h.p. years to the powers now developed on the river, including powers at D'Israeli, Wedon, East Angus, Windsor Mills and Drummondville, as it is calculated that the low water flow will be increased by 500 cubic feet per second. The dam is to be located at the outlet of Lake St. Francis, in the townships of Coleraine and Price, six miles above the town of D'Israeli. The scheme includes the expropriation of numerous farm and wooded areas in the townships of Lambton, Price and Winslow, in the county of Beauce, the total estimated cost, including the dam, being $400,000. The dam will be of the hollow concrete type, consisting of a series of buttresses, five feet wide, and 20 feet centre to centre, supporting an arched apron or deck. The water will be raised 27 feet above low water level of the lake; the capacity of the reservoir thus created is figured at 438 square mile feet. The dam is to be provided with a log slide and three bottom sluice gates, and 90 feet of spillway from elevation 117. Power companies interested have for some time urged the advisability of the construction of a dam, in order to increase the flow of water. The plans were drawn up under the direction of Mr. O. Lefebvre, the chief engineer of the Commission.

Inopportune Time to Increase Expenses

The committee appointed to investigate the questions at issue between the Toronto Hydro-electric System and its employees have brought in both a majority and a minority report. The questions discussed deal largely with wages and protection devices. The majority report brought in by the representative of the men and the chairman of the arbitration board suggests minor changes at certain points in the sub-stations and further recommends that in all except the very small sub-stations two attendants should always be on duty at the same time. In the matter of wages a 10 per cent. increase is recommended beginning May, 1916, in addition to certain fixed holidays and sick leave privileges.

The minority report contests the argument of any necessity for an assistant operator in the various sub-stations. The time of a single operator is far from fully occupied and the objection to adding an assistant under such conditions is obvious. This report further contends that under the present conditions a wage increase would not appear to be a wise procedure.

It is a safe conclusion that on a question of wages the public will agree with the minority report. At a time when few business men are making more than bare expenses and

wages and salaries are being reduced to a minimum it would not appear to be the part of wisdom for a municipal organization, operating at cost, as this is, to add to the already heavy expenses. There does not appear to have been any conclusive evidence presented that the employees of the Hydro System have any greater difficulties in the way of meeting their living expenses than have the employees of other organizations in the city of Toronto, and we believe the men are ill advised in forcing the hand of the Commission at a time when economy is so essential in both private and municipal expenditures.

Cost of Energy for Various Classes

The following interesting decision taken from the Electrical World of August 21 was given by the Public Service Commission of Oregon in a dispute between the citizens of Hood River, Ore., and the Hood River Gas & Electric Company as a result of an application by the company for increased rates. The commission finds that rates are too low and slight increases are approved and ordered.

The Hood River Gas & Electric Company operated in the Hood River Valley, about 60 miles east of Portland, in a highly developed rural community. Available waterpowers along the Hood River led to competition by the entrance of the Hydro-Electric Company. For a number of months rates were cut until finally the interests back of the Gas & Electric company bought control of the Hydro-Electric Company. The offices were consolidated, and temporary schedules were agreed upon pending investigation by the commission.

The substance of the decision may be found in the accompanying table, showing the cost of energy for different classes of consumers in Hood River Valley, and the profit or loss in each class of service, the valuation fixed by the commission, and the extra losses omitted from expense items.

The commission lowered commercial lighting rates, made a slight increase in residential lighting rates, and reduced rural lighting rates by cutting the monthly minimum. The table shows the rates that the commission considered necessary to meet all expenses and an 8 per cent return. The commission stated that it would not be possible to make rates on this basis for the rural districts, because the traffic would not stand it. Practically all the rural business, with the exception of energy for rural motor service, showed a loss on the commission's analysis.

The commission declined to allow as usual operating expenses $2,500 paid in legal fees growing out of a suit during the competitive war, stating that the suit was unnecessary, and also refused to allow a damage judgment of $10,000 to stand as an expense because it contended that with proper operating methods the injury to the workman would not have resulted.

The commission ordered a net rate of 10, 8 and 5 cents per kw.-hr. for residential consumers in the city of Hood River, the rate breaking on two 15-kw.-hr. steps. A minimum monthly charge of $1 was found reasonable. Energy for commercial lighting was ordered to be sold at 10 cents for the first thirty hours' use of the demand and 5 cents for all over that, with a $1 minimum. The order provides for rural rates of 12 cents net for the first 30 kw.-hr. a month, 8 cents for the next 30 kw.-hr. and 6 cents for all over 60 kw.-hr. a month. The minimum was reduced from $1.50 to $1.25 a month. A gross cooking rate of 5 cents was ordered, but it is understood that the companies will reduce this voluntarily to 4 cents gross, with 10 per cent. discount for prompt payment.

Coming Back Through Canada

The International Engineering Congress will be held September 25th, 1915, in San Francisco, California, under the auspices of the American Societies of Civil, Mining, Mechanical, Electrical and Marine Engineers.

Representative Canadian committees of the British Columbia and Alberta members of the British Institution of Civil Engineers, the Canadian Society of Civil Engineers, and the American Society of Civil Engineers, have made arrangements with the Southern Pacific and the Canadian Pacific Railway companies for special train and steamer facilities over these roads from San Francisco, via Victoria, and Vancouver, B.C., and Calgary, Alberta, to Chicago, in order that members of the International Engineering Congress may have the opportunity of a magnificent scenic trip through the Canadian Rockies and of visiting the many interesting engineering works along this route. A hearty invitation is

COSTS FOR DIFFERENT CLASSES OF CONSUMERS OF THE HOOD RIVER GAS & ELECTRIC COMPANY

	City Customers						Rural Customers				
	Residences	Stores	Signs	General Industrial Power	Refrigerator Power	Cooking Power	Domestic Light and Power	General Industrial Power	Refrigerator Power	Cooking Power	Lumber Mills
Operating revenue	$9,844 19	$11,696 54	$46 52	$25,730 03	$3,165.70	$174 76	$10,866 98	$2,203.00	$708 29	$39.33	$3,951.79
Operating expenses	$6,430 52	$3,213.93	$14 16	$788 41	$1,635.21	$129.60	$7,999.80	$1,163.29	$565 13	$32.13	$2,685.25
Depreciation	[illegible],849 09	917 96	2 42	357.98	680 13	46.35	2,246 01	407.13	215.77	6 47	1,013.32
Taxes	569 00	284 30	1.30	69 84	144 64	11 48	707 77	102 56	50 00	2.86	238 21
Uncollectible revenue	214 61	255 00	1 01	56 10	69 02	10 35	225.33	45 66	14 63	.81	81.82
Net operating income less uncollectible revenue	$780 97	$7,025.35	$27.63	$1,300 70	$636 70	$276.97	—$311.93	—$484 36	—$137.29	—$2.91	—$66.81
Value of property in public service	$53,026.54	$25,208.49	$74 37	$8,977.02	$17,413 70	$1,262.28	$56,343.95	$10,078.70	$5,234 59	$159.49	$24,742.64
Working capital, other than stores and supplies	839.15	997.06	3.97	219.32	269.85	40 48	925.90	187.70	60.35	3.35	336.70
Total operating property and working capital	$53,865.69	$26,205.55	$78 34	$9,196.34	$17,683.55	$1,302.66	$57,269.85	$10,266 40	$5,294.94	$162 84	$25,079.34
Return on operating investment, per cent.	1.45	27.08	35.20	14.16	3 60	21.25	—.55	4.81	—2 60	—1.80	—.27
Average revenue per kw.-hr. sold, cents	**7.11**	**8 07**	**8 63**	**5 96**	**1 19**	**5.09**	**12 53**	**3 62**	**1 66**	**5.23**	**2.01**
Average revenue per kw.-hr. sold necessary to yield operating expenses	4.64	2.22	2 63	1.82	.0t	1.39	9.22	1.91	1.33	4 28	1 39
Average revenue per kw.-hr. sold necessary to yield operating expenses, depreciation and taxes	6.38	3.05	3.32	2.82	.93	2.01	12.62	2.74	1.95	5.52	1 95
Average revenue per kw.-hr. sold necessary to yield operating outgo and 8 per cent return, cents.	**9 50**	**4 49**	**4 48**	**4 5**	**1 46**	**3 13**	**18 89**	**4 09**	**2 95**	**7 25**	**3 03**

extended to the members of the Congress who desire to make the trip. Every endeavor will be made to make it interesting both from an engineering and an aesthetic point of view. Round trip tickets from any point in the East may be secured covering the return through the Canadian Northwest, via the Canadian Pacific Railway at the regular rates to San Francisco and return plus $17.50 for the routing by way of Portland, Seattle and Vancouver. For instance, the round trip ticket from New York for the entire trip would be $98.80 plus $17.50.

The trip will include stopovers at Victoria and Vancouver (to view the works of the B. C. E. R. Co.), at Ruskin (the site of the Western Canada Power Company's plant), at Glacier (where the C. P. R. are driving their seven mile tunnel through the mountain), at Seebe (to inspect the generating plant of the Calgary Power Company), at Calgary, at Bassano (where the C. P. R. irrigation system, the largest in the world, is in operation), at Moose Jaw and other important points along the route to Chicago. Any persons desiring further information are requested to enquire of Mr. R. W. Allen, engineer of the Dominion Water Power Branch, and at present in charge of the water-power exhibit in the Canadian pavilion at the Panama-Pacific International Exposition. The return trip between San Francisco and Chicago by way of the Canadian route is calculated to consume about twelve days.

The Cost of Cooking by Electricity

Herewith we print some interesting figures taken from the books of a central station company in a city of some 12,000 inhabitants, showing the kilowatt consumption of the monthly bills in approximately 75 homes where electric ranges have been installed. The rate in this particular city is 3c. per kilowatt hour with a minimum monthly bill of $1.00. Though this rate may not be exactly applicable to many Canadian towns or cities the figures will give a very good idea of the average consumption of the different families in a community where all the household apparatus is electrically operated.

Monthly Consumption of Number of Families Cooking Entirely by Electricity

January		February		March		April		May		June		July		August		September		October		November		December	
Kw.		Kw.		Kw.		Kw.		Kw.		Kw.		Kw.		Kw.		Kw.		Kw.		Kw.		Kw.	
...	....	...	....	...	....	...	....	...	....	...	....	84	$2.20	113	$3.40	172	$5.15	115	$3.45	107	$3.20	112	$3.35
...	....	...	....	...	....	...	....	...	....	123	3.70	153	4.60	68	2.05	41	1.25	7	1.00	15	1.00	9	1.00
18	$1.00	28	$1.00	29	$1.00	40	$1.20	41	$1.25	30	1.00	...	....	...	....	...	....	...	....	...	....	...	....
9	1.00	25	1.00	17	1.00	13	1.00	39	1.15	32	1.00	40	1.20	71	2.15	35	1.05	24	1.00	18	1.00	15	1.00
9	.30	24	1.00	20	1.00	28	1.00	43	1.30	97	2.90	94	2.80	93	2.80	113	3.40	45	1.35	36	1.10	24	1.00
59	1.75	44	1.30	57	1.70	74	2.20	127	3.80	58	1.75	61	1.85	91	2.75	114	3.40	136	4.10	101	3.05	95	2.85
...	....	...	....	...	....	...	....	59	1.75	120	3.60	175	5.25	242	7.50	137	4.10	38	1.15	...	....	...	....
...	....	...	....	...	....	...	....	...	....	97	2.90	138	4.15	202	6.05	34	1.00	248	7.45	46	1.35	50	1.50
10	1.00	11	1.00	9	1.00	21	1.00	10	1.00	35	1.05	144	4.30	197	5.90	130	3.90	36	1.10	40	1.20	33	1.00
32	1.00	42	1.25	29	1.00	83	2.50	72	2.15	104	3.10	126	3.80	128	3.85	122	3.65	47	1.40	76	2.30	45	1.35
...	....	...	....	...	....	...	....	28	.85	64	1.90	90	2.70	108	3.25	86	2.60	12	1.00	21	1.00	8	1.00
144	4.30	206	6.20	77	2.30	66	2.00	96	2.90	119	3.55	99	2.95	74	2.20	81	2.45	55	1.65	72	2.15	76	2.30
8	1.00	6	1.00	24	1.00	18	1.00	53	1.60	64	1.90	48	1.45	99	2.95	61	1.85	51	1.55	19	1.00	...	....
26	1.00	22	1.00	20	1.00	20	1.00	28	1.00	92	2.75	148	4.45	174	5.20	119	3.55	52	1.55	33	1.00	32	1.00
178	5.35	166	5.00	111	3.35	101	3.05	115	3.45	110	3.30	70	2.10	0	1.00	68	2.05	112	3.35	53	1.60	...	....
238	7.15	278	8.35	229	6.85	211	6.35	163	4.60	156	4.70	156	4.70	170	5.10	209	6.25	205	6.15	217	6.50	129	3.85
86	2.60	107	3.20	99	2.95	106	3.20	55	1.65	10	1.00	84	2.50	96	2.90	121	3.65	130	3.90	119	3.55	63	1.90
...	....	...	....	...	....	...	....	...	....	36	1.10	41	1.25	48	1.45	44	1.30	23	1.00	22	1.00	20	1.00
...	....	...	....	...	....	...	....	...	....	165	4.95	107	3.20	177	5.30	157	4.70	...	....	...	....	...	....
...	....	...	....	...	....	...	....	...	....	...	....	41	1.25	158	4.75	237	7.10	267	8.00	236	7.10	147	4.40
9	1.00	21	1.60	10	1.00	60	1.80	85	2.55	106	3.20	93	2.80	106	3.20	120	3.60	93	2.80	112	3.35	83	2.50
20	1.00	35	1.05	30	1.00	31	1.00	36	1.10	94	2.80	144	4.30	221	6.65	101	3.05	32	1.00	20	1.00	23	1.00
122	3.65	159	4.75	144	4.30	159	4.75	135	4.05	183	5.50	207	6.20	160	4.80	143	4.30	116	3.50	129	3.85	127	3.80
51	1.55	135	4.65	113	3.40	107	3.20	102	3.05	92	2.75	112	3.35	70	2.10	42	1.25	86	2.60	65	1.95	75	2.25
20	1.00	7	1.00	9	1.00	21	1.00	42	1.25	64	1.90	147	4.40	170	5.10	140	4.20	91	2.70	56	1.70	68	2.05
20	1.00	70	2.10	68	2.05	93	2.80	44	1.30	30	1.00	86	2.60	92	2.75	74	2.20	82	2.45	62	1.85	9	1.00
...	....	...	....	...	....	...	....	...	....	6	.50	77	2.30	134	4.00	88	2.65	...	....	...	....	...	....
...	....	...	....	...	....	...	....	126	3.80	140	4.20	189	5.65	175	5.25	210	6.30	154	4.60	151	4.50	185	5.55
60	1.80	146	4.40	101	3.05	136	4.10	138	4.15	168	5.05	147	4.40	164	4.90	333	10.00	414	12.45	...	....	...	....
49	1.45	57	1.70	45	1.35	67	2.00	34	1.00	76	2.30	59	1.75	72	2.15	23	1.00	33	1.00	75	2.25	123	3.70
99	2.95	131	3.95	25	1.00	69	2.05	149	4.45	145	4.35	81	2.45	153	4.60	47	1.40	26	1.00	69	2.05	37	1.10
...	....	...	....	...	....	...	....	...	....	...	....	40	1.20	136	4.10	75	2.25	2	1.00	6	1.00	...	....
...	....	...	....	...	....	...	....	...	....	33	1.00	123	3.70	128	3.85	89	2.65	41	1.25	49	1.50	20	1.00
...	....	...	....	...	....	...	....	...	....	176	5.28	202	6.05	208	6.25	208	6.25	212	6.35	50	1.50	...	....
...	....	...	....	...	....	...	....	...	....	...	....	...	....	...	....	140	4.20	159	4.80	241	7.20	139	4.10
...	....	...	....	...	....	61	1.85	94	2.80	64	1.90	77	2.30	38	1.15	7	1.00	166	5.00	109	3.25	...	....
...	....	...	....	...	....	...	....	...	....	31	1.00	21	1.00	52	1.55	14	1.00	15	1.00	18	1.00	...	....
26	1.00	34	1.00	43	1.30	33	1.00	50	1.50	145	4.35	214	6.40	109	3.25	83	2.50	43	1.30	155	4.65	123	3.70
123	3.70	109	3.25	110	3.30	122	3.65	113	3.40	113	3.40	99	2.95	88	2.65	106	3.20	103	3.10	123	3.70	119	3.55
...	....	...	....	...	....	...	....	...	....	...	....	...	....	31	.95	47	1.40	17	1.00	...	....	...	....
...	....	...	....	...	....	...	....	...	....	...	....	...	....	...	....	...	....	109	3.25	152	4.55	135	4.05
136	4.10	109	3.25	84	2.50	114	3.40	60	1.80	...	....	...	....	76	2.30	76	2.30	4	1.00	...	....	...	....
77	2.30	50	1.50	61	1.85	72	2.15	122	3.65	70	2.10	81	2.45	55	1.65	...	....	...	....	...	....	...	....
...	....	...	....	...	....	...	....	...	....	...	....	...	....	17	.50	41	1.25	101	3.05	143	4.30	147	4.40
...	....	...	....	...	....	...	....	...	....	82	2.45	115	3.45	90	2.70	70	2.10	19	1.00	...	....	...	....
...	....	...	....	...	....	...	....	...	....	80	2.40	96	2.90	100	3.00	109	3.25	...	....	...	....	...	....
...	....	...	....	...	....	10	.30	14	1.00	47	1.40	32	1.00	67	2.00	93	2.80	19	1.00	...	....	...	....
22	1.00	12	1.00	12	1.00	28	1.00	53	1.60	140	4.20	171	5.15	181	5.45	133	4.00	20	1.00	21	1.00	25	1.00
...	....	...	....	...	....	...	....	73	2.20	134	4.00	95	2.85	87	2.60	82	2.45	36	1.10	16	1.00	19	1.00
...	....	...	....	...	....	...	....	...	....	231	6.95	292	8.75	190	2.70	207	6.20	...	....	...	....	...	....
...	....	...	....	...	....	45	2.25	110	3.30	100	3.00	95	2.85	72	2.15	33	1.00	57	1.70	67	2.00	75	2.25
...	....	...	....	...	....	35	1.05	47	1.40	48	1.45	90	2.70	90	2.70	70	2.10	28	1.00	22	1.00	27	1.00
...	....	...	....	...	....	...	....	80	2.40	44	1.30	33	1.00	99	3.00	...	....	...	....	...	....	...	....
...	....	...	....	...	....	262	7.85	218	6.55	248	7.45	218	6.55	282	8.45	340	7.70	242	7.25	218	6.55	222	6.65
...	....	...	....	9	1.00	19	1.00	14	1.00	...	....	73	2.20	79	2.35	110	3.30	82	2.45	72	2.15	58	1.75
...	....	...	....	...	....	...	....	...	....	...	....	53	1.60	72	2.15	18	.55	...	....	119	3.55	128	3.85
...	....	...	......	...	....	...	....	22	1.00	12	1.00	12	1.00	57	1.70	11	1.00	227	3.80	89	2.65	100	3.00
...	....	...	....	...	....	...	....	124	3.70	33	1.00	123	3.70	94	2.80	132	3.95	100	3.00	95	2.85	130	3.90
4	1.00	...	....	9	1.00	19	1.00	14	1.00	40	1.20	172	5.15	167	4.00	33	1.00	...	....	25	1.00	...	....
33	1.00	49	1.45	28	1.00	48	1.45	40	1.20	48	1.45	47	1.40	46	1.40	60	1.80	53	1.60	47	1.40	48	1.45
...	....	...	....	...	....	...	....	...	....	...	....	...	....	...	....	...	....	144	4.30	145	4.35	75	2.25
10	1.00	16	1.60	13	1.00	16	1.00	27	1.00	62	1.85	109	3.25	96	2.90	89	2.65	17	1.00	21	1.00	12	1.00
15	1.00	26	1.00	25	1.00	41	1.25	50	1.50	48	1.45	52	1.55	43	1.30	56	1.70	25	1.00	24	1.00	22	1.00
27	1.00	19	1.00	26	1.00	47	1.40	41	1.25	95	2.85	176	5.30	159	4.75	101	3.05	30	1.00	34	1.00	36	1.10
10	1.00	38	1.15	31	1.00	32	1.00	41	1.25	92	2.75	159	4.75	75	2.25	121	3.65	125	3.75	103	3.10	83	2.50
...	....	...	....	...	....	...	....	...	....	42	1.25	26	1.00	124	3.70	52	1.55	25	1.00	...	....	...	....
60	1.80	16	1.00	...	....	...	....	...	....	...	....	16	.50	38	1.15	55	1.65	...	....	...	....	...	....
1	1.00	...	....	2	1.00	13	1.00	16	1.00	205	6.15	157	4.70	201	6.00	104	3.10	20	1.00	31	1.00	52	1.55
...	....	...	....	...	....	...	....	...	....	87	2.60	85	2.55	89	2.65	62	1.85	6	.35	...	....	...	....
165	4.95	155	4.65	142	4.25	44	1.30	...	....	88	2.65	135	4.05	204	6.10	192	5.75	33	1.00	100	3.00	49	1.50
...	....	...	....	...	....	16	.50	13	1.00	8	1.00	15	1.00	12	1.00	14	1.00	12	1.00	10	1.00	8	1.00
174	5.20	167	5.00	146	4.40	232	6.95	188	5.65	139	4.15	174	5.20	160	4.80	254	7.60	259	7.75	211	6.35	193	5.80

Germany's Supply of Copper

Electrical Engineering (London, Eng.) publishes an interesting article on the copper situation in Germany. Evidently our enemies have a considerable quantity of this metal, though in a form, or forms, that will mean untold inconvenience and very considerable expense to convert into fighting material. This humane policy of "inconveniencing" the enemy is being very consistently and persistently carried out by the allies and promises to be much more effective than the spectacular brutality that is being practiced so frequently against us. The article in question follows and is of interest on account of the somewhat novel suggestions for conserving the supply of copper, which opens up a bigger field for the inventive and resourceful characteristics of this undoubtedly clever nation.

Germany's Supply of Copper

"We have before us an authoritative article recently published in Germany on the present position of that country as regards copper supply. It is a broad review of the situation, by a writer evidently possessing a good technical knowledge and more or less accurate information on the subject upon which he writes, and no attempt is made to minimize the great inconvenience which has already been caused by the German Government having taken possession of all stocks of raw and partly-manufactured copper for the Army. It is also admitted that the public must be prepared for more drastic measures in this respect; but one thing stands out clearly and must be noted for the benefit of optimists who persist in construing every move taken by Germany as a sign of an almost immediate collapse. There is copper in Germany sufficient for Army requirements for years and not merely for months; it is true that the "mobilization" of the metal will continue to cause the civil population some inconvenience, but it is equally apparent that, unless the war lasts many years, shortage of copper will not, as has been predicted in some quarters, be a determining influence in bringing the war to a conclusion.

The article, which was published in the "Elektrotechnische Zeitschrift" of July 29th under the title "The Mobilization of Copper," after referring to the requisition by the Army, as already mentioned, of all raw and partly manufactured copper available, estimates the stock of manufactured copper "in the hands of the public" at two million tons. The term "in the hands of the public" is perhaps not quite a happy one for strict accuracy, for a considerable proportion of this stock is in the form of copper roofing on public buildings, etc., which is a feature of German architecture. How soon this stock will be drawn upon is not stated, but the German War Office has already instituted an Office for Metal Mobilization, which on July 20th issued an order for a register to be made of the copper held by certain sections of the public (including electricity and other works) as represented by a large range of manufactured articles, both new and old, consisting wholly or partly of unalloyed copper, including tinned copper, and copper covered with a coating of other metal or paint. A form has been issued to enable the register to be made, and its return is compulsory; there is a column in it in which voluntary offers of copper for sale may be filled in, and the article in our contemporary makes an appeal to copper users to do all they can in this direction, so as to ward off a general calling-up of manufactured copper articles.

"The writer of the article suggests, in the first place, the replacement of all overhead wires by zinc or iron wires, but admits that a difficulty will arise in many cases owing to the fact that the existing poles, insulators, etc., may not be strong enough to carry the requisite heavier weight of these substitutes. To overcome this he proposes that larger voltage drop in the lines should be allowed, and this would enable the copper lines to be replaced with others of smaller section even if the substitution of them by iron wires is not found feasible. This leads him to the suggestion that higher transmission voltages should be resorted to wherever possible, as the copper required for the transformers would be inconsiderable compared with that saved on the line, and he goes further and advises that, to make a virtue of necessity, numbers of the older electric light and power systems should be mobilized. Towns still supplied on the low tension direct current system with long feeders of large section might with advantage, he says, have their systems converted to three-phase high pressure transmission with rotary sub-stations at the feeding points, but he does not insist upon these drastic measures being taken immediately. In Germany, as in this country, there are large numbers of reciprocating sets standing comparatively idle as "reserve plant" in electricity works in which the load is regularly taken by modern turbine machines. The amount of copper in these per kw. output is of course far greater than in the turbo-generators, and he invites serious consideration of the "slaughter" of these innocents in the service of the Fatherland. Finally, the writer even goes so far as to suggest the reconstruction of many of the older transformers, to utilize the newer iron alloys for their cores, and so to diminish the proportionate weight of copper.

"Obviously some of these measures are extreme ones—some, indeed, hardly merit serious thought. It must not be inferred, however, that this implies an immediate copper famine, any more than the issue of bread tickets in Germany months ago presaged an immediate bread famine. There has been sufficient evidence during the past year of the useful German habit of looking forward and methodically providing for any emergency, and the moral to be drawn from such articles as the one now reviewed is that, although Germany is provided for a long time to come with sufficient copper for war requirements, yet she is prepared to adopt heroic measures for providing further supplies should emergency arise. The auther of the article, in fact, uses the argument that, although it may be long before the more easily acquired stocks of copper will be exhausted, yet the modifications in existing conditions which he outlines will also take long to carry out, and that therefore it is not too early to give consideration to them."

Hydro Project on Elbow River

The Dominion Government has recently issued an agreement under the Dominion Water Power Regulations covering a water power project on the Elbow river about 35 miles from Calgary. The agreement stipulates that the Department must be furnished with complete plans and specifications by the 15th July, 1916, of a scheme of development, the general plans of which have been worked out by Messrs. DuCane, Dutcher & Co., Consulting Engineers of Vancouver, and which have already been accepted by the Dominion Water Power Branch; that actual construction operations must be commenced within six months of official notification of Departmental approval of these complete plans and specifications; that such operations must proceed continuously and a minimum of 2,000 mechanical horse power must be developed and available for use by the 15th of July, 1909; that the power plant, when completed, must be operated in the general public interest to the satisfaction of the Minister of the Interior. Absolute control is retained by the Minister of the rates to be charged for the power output, and an adequate rental for the privileges granted has been provided for. Provision is also made for the taking over of the project by the Government should such a course ever be deemed necessary.

The "Science" of Electric Cooking (Con.)

Results of Experiments in Roasting—Too High Temperatures Retard the Cooking Process—Size of Oven an Important Factor—Ample Evidence that the Exercise of Scientific Intelligence in Roasting Operations is Well Repaid in Higher Quality and Lower Costs

Experiments in Roasting Beef

Meat may be cooked by any of the methods in common use for the cooking of food of which the most important are: roasting, baking, frying, broiling, stewing, and boiling. Until recently there has been little known concerning the scientific principles of cooking meat. Since there has been no uniformity in the processes of cooking the terms vary widely in their meaning. Roasting, which was formerly applied to cooking over red hot coal, is now used synonymously with baking or cooking in an oven by means of dry heat. Stewing and boiling have not been clearly defined. Both apply to the cooking of meat when immersed in hot water. The present tendency in scientific literature is to use the term boiling when meat is cooked in hot water at any temperature and to specify the exact temperature used. Broiling and frying will not be discussed in this paper, as it is impractical to utilize the advantages of an insulated electric oven for preparing the meat by either method.

There is a wide diversity of tastes in regard to the proper degree of cooking of a meat roast. Some people prefer that meat should be heated only enough to slightly change the color of the interior of the meat, while others prefer the meat to be cooked until every trace of the pink color has disappeared. This difference in taste causes a corresponding variation in the meaning of the terms used to describe the degree to which meat shall be cooked. The meat which one person calls rare is medium rare to another, and oftentimes meat which is actually raw is served as rare.

Experiments have demonstrated that beef can be satisfactorily roasted at an oven temperature anywhere between 100 deg. and 200 deg. cent. A beef roast prepared at any temperature within this interval was found to be well browned and attractive looking. No difference was discernible in the tenderness of duplicate roasts cooked at the extremes of temperature. In their opinion, the flavor and juiciness of the meat was slightly better at the lower temperatures, whereas at the higher temperatures the drippings were better flavored and larger in quantity.

Since a roast of beef can be properly prepared at any temperature between 100 deg. and 200 deg. cent., the most satisfactory temperature within this interval can be determined only by the consideration of other factors, of which the time of cooking and the cost of cooking are the most important. In order to determine this most economical temperature for roasting a rolled rib roast, a series of experiments were performed.

Twenty-two roasts consisting of the third and fourth standing rib cuts, were obtained from the local market. The meat was freed from bone and tightly rolled and secured with wooden skewers. Samples were roasted at 100, 120, 140, 160 and 180 deg. cent. The time required for the cooking and the amount of energy used at each oven temperature was measured. From these values the most economical temperature for roasting a rolled roast was determined.

In order to get uniform results in the degree of cooking the meat, it was necessary to decide on a rather exact method of determining when the meat was sufficiently cooked. As mentioned before, the aim in cooking meat is not to increase its digestibility, but to improve its flavor and appearance. This is accomplished by decomposing the red coloring matter called oxyhaemoglobin, which removes the raw appearance of the meat. The inside of the roast should be heated sufficiently to accomplish this without overcoagulating the proteids or removing from the meat those substances which tend to become soluble or volatile upon the application of heat.

If the inner temperature of a roast is between 55 and 65 deg. cent. the meat will be rare, if it is between 65 and 70 deg. cent. it will be medium rare, and if between 70 and 80 deg. cent. it will be well done. In order to secure as much uniformity as possible in the results, a definite temperature rather than a range of temperatures was taken as the indication of when the meat was sufficiently cooked: 55 deg. cent. was used for rare, 65 deg. for medium rare and 75 deg. for well done.

It is not always possible to obtain the exact inner temperature to a degree, because if the roast is taken out of the oven when the inner portion of the meat is at some particular temperature, say 60 deg., this temperature will not begin to

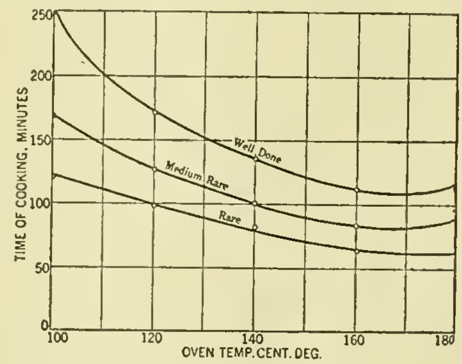


Fig. 6.—Effect of oven temp. on time of cooking roast beefs.

decrease immediately, but will first increase several degrees before it begins to decrease. This increase of temperature after the roast is removed from the oven depends upon the temperature of the oven in which the meat is cooked, being greater for a high oven temperature.

A copper-constantan thermo-couple was used to measure the temperature inside the roast. The thermo-couple was connected to the recording galvanometer which gave a continuous record of the temperature inside the roast.

The authorities on meat cooking recommend that a roast be cooked for the first 10 or 15 minutes at an oven temperature of 250 deg. cent. so as to sear the outside of the meat. The theory is that the coagulation of the outer surfaces of the meat will act as a seal to keep in the meat juices and volatile flavors. A consideration of the heating curves of the electric ovens discussed in the first part of this paper, shows that to heat an oven up to 250 deg. cent. and to keep it there for 15 minutes will increase the cost of the electricity for roasting the meat about 50 per cent. In order to reduce this extra cost of energy another method was tried which proved very successful. Instead of searing the meat in the oven at a high temperature it was seared on the top of the

stove or rather by placing the meat in an aluminium dish over an 880-watt heating coil. The current was turned on for three minutes to get the dish quite hot. The meat was then placed in the hot dish and seared for ten minutes, being turned frequently so as to sear all sides.

After searing an incision was made in the roast with a sharp narrow bladed knife, and the thermo-couple was inserted as near as possible in the centre of the large muscle of the roast. The roast was then placed in the oven at the desired temperature. Placing the roast in the oven lowered the temperature from 10 to 20 deg. Full current was turned on until the temperature returned to the desired value, after that the temperature was kept constant within 2 deg. cent.

When the temperature inside the roast indicated the meat to be cooked rare, the time and watt-hour readings

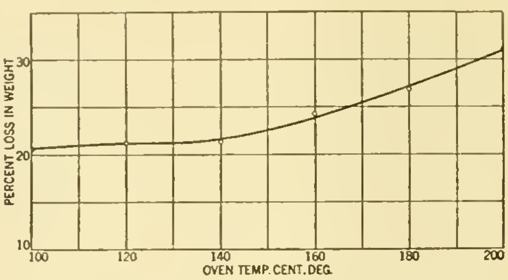


Fig. 7.—Effect of oven temp. on loss in weight of rib roast.

were recorded. This was also done for medium rare and well done. As soon as the inside temperature indicated the meat to be well done, the roast was taken out of the oven and left on a shelf in front of the oven, the leads of the thermo-couple being long enough so that it could still be left inside the meat. The meat was allowed to stand until the temperature had reached its maximum value. After being weighed and cooled on ice it was cut into and examined.

Table I.

Temp. of oven cent. degrees.	Time of cooking of meat roasts in min.			
		Rare		
100	121	122	120	121 Ave.
120	107	89	97	98 Ave.
140	99	76	71	82 Ave.
160	53	71	67	64 Ave.
180	80	58	53	63 Ave.
		Medium Rare		
100	162	176	170	169 Ave.
120	139	114	124	126 Ave.
140	111	89	106	102 Ave.
160	75	91	86	84 Ave.
180	105	82	75	88 Ave.
		Well done		
100	241	260	248	250 Ave.
120	177	165	172	171 Ave.
140	151	124	132	136 Ave.
160	164	120	113	112 Ave.
180	135	105	113	118 Ave.

Table I. gives the time of cooking of the roasts for rare, medium rare, and well done. Fig. 6 shows the average time of cooking plotted against oven temperature. It will be noticed that at an oven temperature of 160 deg. cent. the roasts are cooked in a shorter length of time than at 180 deg. This is probably due to the fact that the slightly charred surface of the meat is a poorer conductor of heat. For the well done roasts the time of cooking increases rather rapidly as the temperature decreases. This is not a disadvantage, however, if the temperature can be obtained automatically without the attention of the cook.

Table 2 gives the weights of the roasts before and after cooking and the per cent. loss in weight due to the cooking. The average values of the per cent. loss in weight of the roasts in cooking are plotted in Fig. 7. It will be noticed that the per cent. loss in weight of the roasts increase with the temperature. The curve shows that as far as the losses in cooking a well done roast are concerned, meat is best when cooked between 100 and 120 deg. cent., or possibly lower.

Table II.

Temp. of oven cent. degrees	Weight before cooking grams	Weight after cooking grams	Loss in weight	Per cent loss in weight	Average per cent loss
100	1904	1502	402	21.1	
	1600	1288	312	19.5	
	1760	1392	368	20.9	20.5
120	1580	1270	310	19.6	
	1782	1380	402	22.6	
	1824	1434	390	21.4	21.2
140	1700	1352	348	20.5	
	1900	1492	408	21.5	
	1820	1414	406	22.3	21.4
160	1554	1160	394	25.3	
	1612	1237	375	23.2	
	1566	1182	384	24.5	24.3
180	1628	1220	408	25.1	
	1832	1335	497	27.1	
	1814	1300	514	28.3	26.8
200	1805	1244	561	31.0	31.0

As the proper facilities were not available no attempt was made to analyze the drippings obtained at the various temperatures to determine the proportion of water, protein and fat. The appearance of the drippings, however, would indicate that there is a larger proportion of fat in the drippings obtained at high oven temperatures than at the low temperatures.

The other important factor which determines the best

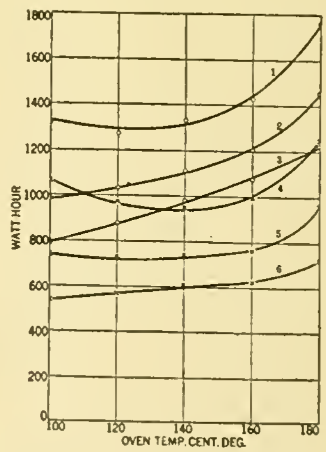


Fig. 8.—Energy required to roast beef in oven No. 1 starting with oven hot and with oven cold—searing, 190 watt-hr. additional.

1. Well done roast oven cold. 4. Well done roast oven hot.
2. Med. rare " " " 5. Med. rare " " "
3. Rare " " " 6. Rare " " "

roasting temperature is the cost of the electricity used. The curves of Figs. 8 and 9 give the energy used in roasting beef in ovens No. 1 and 2 starting with the ovens at the required temperature and starting with the oven at room temperature. The energy used in searing the roasts is not included in the ordinates of these curves, since it was the same in all cases, 190 watt-hour. It will be noticed that for rare roasts 100 deg. is the most economical temperature in each oven; for the medium rare 100 deg. is the most econ-

omical except for oven No. 1, for which 120 to 140 deg. is the best. The difference in this case is very slight, however, and within the probable error, so that 100 deg. could be used economically even here if desired. For the well done roasts there is a decided difference in the cost of cooking the meat at the various oven temperatures. For all the ovens the most economical temperature for the well done roasts lies between 120 and 140 deg. cent.

It will be noticed that when preheating is included the rare and medium rare curves are much steeper, and that

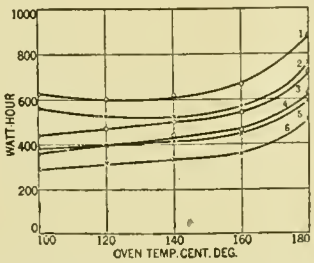


Fig. 9.—Energy required to roast beef in oven No. 2, starting with oven hot and with oven cold—searing, 190 watt-hr. additional.

1. Well done roast, oven cold. 4. Rare roast, oven cold.
2. " " " " hot 5. Med. rare roast, oven hot.
3. Med. rare " " cold 6. Rare " " "

the difference between the cost of preparing a roast at 100 and 180 deg. is greater. For ovens No. 1 and 2, 120 deg. is the most economical temperature for well done roasts. While the cost of electricity at $.05 per kw.-hr. for oven No. 1 the difference between the cost of roasting meat at 100 and 180 deg. is $.02 for rare and $.025 for medium rare, and for well done the difference between 120 and 180 deg. is $.025. The saving in the month's bill would probably amount to about $.50, depending, of course, on the number of roasts prepared. It is well worth considering, however, as by observing these economies electric cooking will be able to compete with cheaper fuels.

It will be noticed that the energy required for roasting meat in oven No. 1 is considerably greater than for oven No. 2, and partly to the larger size of the oven. The oven was much larger than was necessary for cooking a roast of this size. On this account both the radiation and the preheating loss were much greater than in the smaller oven.

An experiment was tried by searing the roasts in the manner recommended by the cook books. The oven was heated to 250 deg. the roast was placed therein, and full current was turned on until the temperature had returned to the desired value. The current was then turned off and the oven allowed to cool down to 100 deg., where it was kept constant during the remainder of the experiment. The energy required to prepare the roasts by both methods is given in the following table:

Table III.

Watt-hours Used in Preparing Roasts by the two Methods of Searing

	Searing on top coil	Remainder of test in oven at 100 deg.	Total	Total when seared in oven	Difference
Rare	190	790	880	1950	1070
Well done ..	190	1325	1515	2580	1065

The saving in energy in favor of searing on top of the stove is surprisingly great, making a difference of $.05 (at $.05 per kw.-hr.) in the cost of preparing the roast. This great difference in energy used by the two methods is due to the fact that when searing the meat in the oven the whole oven has to be heated up to the high temperature of 250 deg.; resulting in large preheating and radiation losses, while by the other method only the heating element, the dish and the outside surface of the roast are heated to the high temperatures. The losses are consequently greatly reduced.

(Baking experiments continued in next issue.)

New Books

Standard Handbook for Electrical Engineers—The McGraw-Hill Book Company, Inc., New York, publishers; edited by Frank F. Fowle, S.B., M.A.I.E.E., etc., assisted by a staff of specialists; price $5.00. This is the fourth edition of the Standard Handbook of Electrical Engineers and embodies so many changes and so much new matter that it is virtually a new book, though the general features and scheme of arrangement, outer appearance, etc., have been maintained. As with the earlier editions the handbook is intended primarily as a reference book of practical information and data for practising engineers and a supplement to the standard text-books used and followed in the universities. Though it must, of course, be recognized that limitations of space render it impossible to treat each subject exhaustively, the efforts of the editors have been successfully concentrated on the task of presenting as much information and data of a practical nature as space would permit, reducing descriptive matter to a minimum and relying on standard works for more complete explanations of theories and highly special topics. This handbook will continue to form a valuable part of electrical men's libraries in whatever phase or stage of the work they may be engaged.

Alternating-Current Work—By W. Perren Maycock, M.I.E.E. Whittaker & Company, London and New York, publishers; price 6s. This is virtually a revised and extended edition of an earlier work, "The Alternating-Current Circuit and Motor," by the same author, but the original matter has been thoroughly overhauled and its scope enlarged so as to embrace alternators and transformers. The subject matter is treated under the following heads: 1. Introduction; 2. General Principles; 3. Power, Polyphase Currents, etc.; 4. Alternators; 5. Transformers and Choking Coils; 6. Motors. 415 pages; size about 5 in. x 7½ in.; fully illustrated.

Wage Dispute in Vancouver

Claiming that they were "locked out," Vancouver Local No. 213 of the Electrical Workers' Union charged the B. C. E. R. Company with a technical breach of the Labor Act in the police court Aug. 2nd. An adjournment was granted counsel for the company after a strenuous opposition by counsel for the men. The latter stated that the agreement between the company and the men expired some time since and that the company had notified the men of their intention of reducing the wages 10 per cent. and altering working conditions. To this the men would not agree, declaring their willingness however to go to work at the old scale. It is the claim of the men that they should be allowed to continue work at the old scale until the decision of the conciliation board, which body is attempting to settle the dispute between the company and its employees, is reached.

Zinc Smelting in Welland

The Canadian Zinc Company with a capital of half a million dollars is being incorporated to operate in Welland, Ontario. Ore will be shipped from the mines of the Weedon Mining Company and smelted in electrical furnaces at Welland. A request has been made to the local hydro commission for a price on 4,000 h.p. of energy.

Electric Plant for Sydenham, Ont.

It is said that Mr. H. M. Woodruff has sold out his rights in the water power in the village of Sydenham to a company composed of Renfrew citizens who will install an electrical generating plant. It is understood also that the power will be used to operate a sash and door factory which is to be established but there will be ample surplus for supplying light and power to this and surrounding villages.

Generating Power from Montreal Aqueduct

Promises to be prohibitive in cost—Agitation under way for full report by a competent engineering board

The scheme for enlarging the Montreal aqueduct for the purpose of generating power for pumping and street lighting, has been the subject of some trenchant criticism on the part of the Council of the Canadian Society of Civil Engineers and Mr. J. A. Jamieson, consulting engineer, of Montreal. Bound up with this scheme is a filtration plant and water conduit, but the chief part of the criticism is directed to the hydro-electric section, which is regarded as extravagant and uneconomical. The Canadian Society of Civil Engineers ask for the appointment of an independent board of engineers to examine the whole project before further money is expended, and Mr. Jamieson also put forth a plea to the same effect.

The latter, in an open letter to Controller Cote, traces the history of the project from the date it was planned by Mr. G. Janin, the city engineer, to develop 2,000 h.p. at a cost of $2,200,000, to the present time when it is proposed to spend at least 7½ millions to develop 10,000 h.p. This may or may not be the total cost, as no report has been made on the scheme as it now stands. The power house, hydraulic and electric machinery, regulating gates, etc., have not yet been designed or put under contract. Mr. Jamieson criticizes a report made by Hering & Fuller, consulting engineers, of New York, on the 2,500 h.p. proposition, contending that it is based on the untenable assumption that the science and practise of engineering has not advanced during the past half century, and entirely ignores the important development in the electrical transmission of energy during the past 25 years, which has made it economical to develop hydraulic power at points where it could be developed most cheaply and delivered at points of consumption by transmission lines at a price very much below the cost of generating from coal or by such local development as the aqueduct.

Hydro-electric engineers of high standing, and conversant with the facts, compute the cost of development of hydro-electric plants per horse power as follows:

Average cost of hydro-electric development throughout Canada, $125 per h.p. Average Niagara Falls development, $110 per h.p. Average cost of various developments within a transmission radius of Montreal (Chambly and St. Timothe, Canada Light and Power Company excluded), $107 per h.p. Cedar Rapids, 100,000 h.p. now completed and in operation, $90 per h.p., and when the full 160,000 h.p. is completed, $75 per h.p.

These costs of development per horse power are based on the maximum power obtained during the low-water season, or under conditions in winter, and cover the entire cost of the development, including the hydro-electric machinery and equipment ready to generate electric energy, but do not include the transformers or the transmission lines to deliver the electric energy at points of consumption. The cost of these latter varies with the distance, but may safely be taken for Montreal district at an average capital cost of $15 per h.p. between the different plants and the sub-stations within the city limits.

The amount of power which can be obtained from the aqueduct now under construction by the city depends on the net head of water obtainable at the power house during the winter months and the volume of water available under this head. Computations based on the data available show that during the winter months, when the aqueduct will be covered with ice and back-water in the tail-race, governed by the average level of the water in the St. Lawrence at the point of discharge, a total of 7,500 h.p. may be obtained under good normal conditions. This amount of power is, however, liable to be greatly reduced during severe winter weather by floating ice and frazil formed in the open water of the river between the intake and Lake St. Louis, and drawn into the aqueduct by the large quantity of water required to generate the power. That frazil trouble is more than a probability is shown by the experience of the Lachine Rapids development of the Montreal Light, Heat and Power Company, located a short distance below the aqueduct entrance, from which it is well known that only a very small amount of power can be obtained during the winter months, due to frazil blocking the forebay, racks and wheelpits. The aqueduct power will always be greatly reduced during the spring ice-jam below the city, and always liable to be drowned out by back-water each spring for periods of a week or more.

Under these conditions Mr. Jamieson contends that it will be necessary for the city to maintain an auxiliary steam plant or to purchase additional hydro-electric power for a certain period. He contends that it would have been a businesslike proceeding to have had the whole project reported on by qualified and experienced hydro-electric engineers familiar with our winter conditions before proceeding with the scheme. It would, no doubt, have been found that for much less money than the city is now spending on the aqueduct a power site in the vicinity of Montreal could have been found and developed which would have produced from five to seven times the amount of power, which could have been sold to power and light consumers in the city at a low price, and which would have given the city electric energy for all their power and light requirements free of cost for all time to come.

Will Cost $1,000 per h.p.

This aqueduct scheme, if carried out in accordance with the present general plans, will apparently cost the city for power development alone $7,500,000, and this based on the probable power obtainable under good, normal winter conditions, will equal a cost of $1,000 per h.p. for development, or over eight times the average cost of hydro-electric development in the vicinity of Montreal, including the necessary transmission lines to deliver the electric energy within the city limits.

This is an unprecedented cost for a power development in any part of the world, and particularly for hydraulic development which will require an auxiliary steam plant or hydro-electric standby equal to nearly 100 per cent. of its normal capacity.

Controller Cote has replied to this letter, maintaining that as the project has been reported on by a large number of engineers, no further investigation is necessary. The scheme, he insists, is a good and economical one, and will give all the necessary power for pumping and street lighting. He estimates the normal outlay of pumping and lighting at $495,000, representing at 5 per cent. a capitulation of $9,900,000, a "sum very much in excess of the $7,000,000, which the development would cost, and leaving a very substantial margin for installation and transmission charges, and naturally the municipality is in possession of its own privileges at the lesser cost." Mr. Cote declares that 10,000 horse power will be developed, and that there is no danger from frazil ice such as is feared by Mr. Jamieson.

The following is a reply by a Montreal engineer to Mr.

Cote's letter, and puts the case squarely for the critics of the civic plan:

Mr. Cote's letter while on the face of it showing a reasonable statement in favor of the expenditure of $7,000,000, for the provision of hydraulic plant for pumping the city water omits several items of expense which, when added, do not support his theory that the scheme is financially sound; in fact shows it as a scheme which can never be other than an extravagant one from a power point of view. Mr. Cote's argument is as follows:

	1914
Pumping, cost of coal	$170,000
Electric power for pumping at McTavish street station	50,000
Street and civic lighting	275,000
	$495,000
This amount capitalized at 5 per cent	$9,900,000
Estimated cost of development	7,000,000
Leaving for pole lines, etc.	2,900,000

This calculation in reality would tend to show that the whole cost of pumping and street lighting would be the interest on the money expended as capital and that there would be no running charges.

Furthermore, it is supposed that the sum of $495,000 per annum is the cheapest method of doing the pumping and lighting and that if this sum is equalled there is a prima facie case for the construction of a vast power plant. It does not need an engineer or a financier to offer figures to show that the reasoning of Mr. Cote quoted above is incomplete and dangerously so. Let us take the figure of $7,000,000 and allow the interest rate of 5 per cent.—this gives

$7,000,000 at 5 per cent.	$350.,000
We now have depreciation which cannot be taken at less than 2 per cent. by any reasonable person	140,000
Operation of plant and wages of attendants, oil, grease, etc.	25,000
Repairs and maintenance of aqueduct, pumps, etc.	25,000
The cost of distribution system for arc lamps, pumping and general lighting, will not be less than $750,000.	
Interest 5 per cent., Depreciation 10 per cent., Mtce. 2 per cent.—17 per cent. on $750,000	127,500
Operating of arc system 3,300 arcs at $20 per annum	66,000
Operating power plant at different substations, engineering costs, etc.	16,500
	$750,000

Now, this will he an advance, on the present operating cost, of $250,000 per annum without any improvement in service and with the additional burden that whereas the present cost gives a profit to the coal suppliers and the electric power companies, which benefits the citizens of Montreal, the money spent on the aqueduct will merely carry interest charges which have to be paid to outsiders forever.

A Cheaper Method

The question, however, which arises is—is there any other method cheaper than the present method?

Mr. Cote in his letter states that the usage of the pumps during June is as follows:

1,623,000,000 gals. against a head of 212 ft. Allowing an electric pump to have an overhead efficiency of 68 per cent. we find this is equal to an average of 3,550 h.p. Allowing for sudden demands we could figure 4,000 h.p. as the needed load.

Now, under the city contract with the electricity supply company the city can buy 24 hour power at $30 per h.p. per annum or 20 hour power at $20 per h.p. per annum. The hours of service under 20 hour power would require the city to pump the water in 5/6 of the time. Therefore, the power required would be 6/5 x 4,000 h.p. or 4,800 h.p., say 5,000 h.p. The cost to the city for operation would therefore be

City pumping	$100,000
City pumping	50,000
City lighting	275,000
	$425,000

or for $325,000 cheaper than estimated cost and $50,000 cheaper than present cost.

It should also be noted that in Mr. Cote's figures of present cost he does not allow any repairs, maintenance and wages for boiler and steam plant at present in use, and in view of the repeated breakdowns to the pumps this must be a very high figure. If these be added and also the loss in coal pile added, fire insurance and accruing depreciation on existing equipment, there is no doubt that the city could save $50,000 per annum over present cost, by merely adopting the use of the present city contract for electricity to the existing conditions.

Stop the Work Now

The question which now arises is: Is it too late to change the conditions, and will the interest on the charges already incurred added to the costs as above, exceed the interest charges on the money already spent and to be spent? This requires a knowledge of the money already spent and contracts given which must be completed. If we estimate that there will be an additional amount of $3,500,000 to be spent and $3,500,000 already spent we get the following figures:

Cost—cheapest method	$425,000
Interest at 4½ per cent, $3,500,000 already borrowed	157,000
	$582,000 per annum
Cost as per previous estimate if the plant be completed	750,000
or a saving of	$228,000 per annum

if the plant be not completed. Therefore why complete it?

Mr. Cote in his letter, of which there has been no correction, states that the coal cost for June 1915 amounts to 3,239 at $2.65 per ton or $8,580 for the month. Now the yearly cost is given as $170,000 or at the rate of $15,833.33 per month, or nearly double. There must be an error here, and the use of a low figure for June to show cheap operation is hardly fair if the plant uses double as much in other months.

Again the use of coal as being the only apparent item of expense is misleading. What is wanted is the whole cost of pumping the water, including wages of all men, engineers, firemen, coal passers, oilers, etc., together with all repair expenses and small charges for waste, oil, etc., incidental to the use of a steam engine and boiler plant.

If there were anything untried in the matter of pumping water electrically, there might be some doubt as to its efficiency, but when we have the Montreal Water and Power Company, which pumps as much and more water than the city and does so electrically from a power company's supply, and has done so for many years, there is no reason why the city should spend millions upon a project which can at best prove more expensive than present methods and at worst three times as expensive as need be. A comparison of the cost of water pumping between the Montreal Water and Power Co. and the city would be illuminating. Several times

there has been mentioned the possibility that the various electrical companies in the city will combine and raise the price of power, but there is no doubt that the city can now make contracts for any length of period they like at most favourable rates or extend the present contract for long periods.

The following is an estimated cost of pole lines:

In order to take care of 4,000 odd lamps it will be necessary to set some 18,000 poles.

16,000 poles erected at $16 a piece	$256,000
3,300 lamps at $30 a piece	99,000
4,200 fixtures at $7	29,400
292,600 lbs. wire at 20c. per lb.	58,520
Pole line material at $2 per pole	36,000
Cut outs, 3,300 at $6	19,800
Total	$498,720
Labor at 40 per cent. on all material	96,800
Contingencies, engineering, use of tools	25,000
	$620,520
Station equipment:	
70 sets at $1,000 a piece installed	$ 70,000
Tie lines between substations	55,000
Transformers, 3,000 k.w. at $225 per k.w.	6,750
Bus bar cells, oil switches, etc.	25,000
	$777,270
Total estimated expense for building pole lines to take all the city arcs, distributing from 2 present city pumping stations and carrying city pumping load from these sub-stations, as well as arc lights	$800,000

The Merits of Synchronous Converters

As compared with the Synchronous Motor-Generator—Recent developments give Synchronous Converters wide range of service as compared with few years ago

By Mr. W. G. Gordon*

In comparing the relative merits of synchronous converters versus motor-generators it is necessary only to consider the latter when driven by a synchronous motor, as the lagging current taken by an induction motor makes the synchronous motor preferable in the large majority of cases.

The usual objections to the synchronous motor as compared with the induction motor are the low starting torque of the former and the separate excitation it also requires. These objections, however, do not apply when the motor is used in a motor-generator set. As the set is not started under load, a high starting torque is not required and a direct connected or belted exciter can readily be provided for the motor excitation.

As this is the case, we will only consider the synchronous converter as compared with the synchronous motor-generator set.

For power-factor correction the motor-generator is superior to the synchronous converter. With the former the motor can be adjusted for any power-factor without affecting the operation, and the direct voltage can be adjusted independently.

If desired, a voltage regulator may be used to hold constant voltage at the motor terminals.

The direct voltage of the motor-generator set is entirely independent of the alternating voltage, while with standard pole synchronous converters this is not the case. However, by providing a series field winding and extra reactance the converter can be compounded to compensate for the line drop as the load varies.

The voltage of the motor-generator set varies with the frequency, while that of the converter does not.

The converter has the marked advantage of high efficiency at all loads, with a resulting high all-day efficiency. As synchronous motors can readily be built for voltages up to 13,200, it is necessary in comparing the respective efficiencies, where the supply alternating voltage is not above this, to include the transformer losses with the synchronous converter.

Even with this allowance it is found that the combined efficiencies of 25 cycle converters with step-down transformers are from 5 to 8 per cent. better than for motor-generator sets of corresponding sizes. Where the supply alternating voltage exceeds 13,200 the transformer losses with the motor-generator set will show still further gains in the converter efficiencies.

Special direct voltage control is not necessary for railway operation; but where it is required, the regulating-pole converter or converter with series booster will give a direct voltage range, or it can also be obtained from a shunt wound converter with induction regulator.

For railway work the use of the commutating pole has meant a marked advance in converter design. Standard railway synchronous converters are constructed with a compound field, which is designed to give a practically constant direct voltage between no load and full load. As above stated, this regulation is secured by providing extra reactance. This was formerly provided by separate additional reactance coils; but transformers are now built for this service with special coil relation to give them about 15 per cent. inherent reactance.

The large majority of interurban roads are now operating at 1,200 or 1,500 volts direct current. The use of commutating poles has made practicable the use of higher voltages per bar and higher commutator speeds, resulting in a much greater output per pound weight; and synchronous converters can be designed to operate at any voltage up to 1,500 volts up to a frequency of 35 cycles, consequently with 25 cycles, a 1,500 volt synchronous converter is entirely satisfactory in design.

Owing to inherent limitations in design, 650 volts is about the maximum voltage which can successfully be obtained from a single 60 cycle converter. Two 1,200 volt converters are now being successfully operated in series at 33 cycles to give 2,400 volts, the converters in this case being insulated for 2,400 volts.

Where it is desired to get direct voltage up to 1,500 from a 60 cycle system, a motor-generator set is generally used as the desired voltage can be obtained from one generator.

By the use of commutating poles the synchronous converter for railway service can be designed so that the continuous ratings of the units more nearly equal the average load values. Standard design of converters for this service provides satisfactory commutation for peak overloads of one minute of 200 per cent. overload. This means a much better all-day efficiency than was possible with the older

*Transportation Engineer, Canadian General Electric Company.

designs; and further, the units being smaller require less floor space.

The use of the commutating pole introduced one difficulty which, however, was readily and simply overcome. When a commutating pole synchronous converter is being started from the alternating current side, severe sparking will be set up under the brushes on the commutator due to the leakage flux through the unexcited commutating poles. To avoid this, by a simple mechanical arrangement all the brushes but two are raised by a single lever, and a semaphore at the top of the field frame indicates whether the brushes are up or down. The sparking caused by these 2 pilot brushes is harmless, as the brushes are very narrow, thus short circuiting a considerably lower voltage than the main brushes would do. These two pilot brushes provide current for the field excitation and also are used to indicate the polarity.

The combination of compound wound converters and transformers with inherent reactance for railway work gives practically flat compounding from no-load to full-load. The combined field strength of the shunt and series windings is set for minimum alternating current input at average load, by adjusting the shunt field rheostat. The series field winding on the converter changes the excitation of the field with variations in load, and causes lagging or leading alternating current to flow, dependent on whether the load is less or greater than the unity power-factor setting.

If the load is less than unity power-factor setting, lagging current flows and if greater, leading current flows. With the inherent reactance in the transformers the flow of lagging or leading current decreases or increases the alternating current voltage applied to the collector rings of the converter as the load on the converter changes, and thereby compensates for the decrease in voltage due to the resistance drop in the converter armature and the regulation of the transformers. This combination insures the delivery of approximately constant direct current voltage at the synchronous converter terminals.

As earlier stated, where special direct current voltage control is desired, it can be obtained with a regulating-pole synchronous converter, a synchronous converter with series booster, or a shunt wound converter operating in conjunction with an induction regulator.

With the regulating-pole synchronous converter, the variation of the voltage ratio is not obtained by a variation of the impressed alternating voltage, but by varying the distributed flux under the poles. The field structure is divided into two parts, a main pole and a regulating pole; and the ratio between the direct and alternating voltages can be readily varied by varying the excitation of the regulating poles, the only auxiliary apparatus required being a special field rheostat for controlling the exciting current. Where automatic regulation is desired the converters can be provided with compound windings, or automatic field regulators may be used.

These converters can also be operated inverted if it is required to furnish constant or variable alternating voltage from a direct current source.

In the earliest form of the regulating-pole converter, the field poles were divided into three equal sections, each provided with two separate field windings,—one main and one regulating winding. The three coils of the main winding on each pole unit were all connected in series, thus acting as one pole. The coils of the regulating winding were also connected in series, but in such a way that the coils on the outside pole-sections magnetized in one direction, while the middle coil magnetized in the opposite direction.

In the latest form of this converter, each pole is only divided into two sections, one of which constitutes the main pole, the other, considerably smaller, constituting the regulating pole. For normal voltage the main pole is excited, while in order to raise or lower the direct voltage the regulating pole is excited so as to assist or oppose the effect of the main pole.

The synchronous converter with series booster generally consists of an alternator with revolving field mounted on the same shaft as the converter armature. The armature of the alternator, or booster, as it is usually called, is stationary and connected electrically in series between the supply circuit and the collector rings of the synchronous converter. The booster field has the same number of poles as the converter and is generally shunt wound.

A change in the booster voltage will correspondingly change the alternating voltage impressed on the converter and this regulation can, of course, be made so as to either increase or decrease the impressed voltage by means of strengthening or weakening the booster field. The voltage variation can be made either non-automatic or automatic; and, in the latter case, it becomes necessary to provide a motor-operated rheostat controlled by suitable relays, or the booster can be provided with a series field. By means of the booster it is possible to vary the direct voltage of the converter with a constant alterating supply voltage, and this voltage regulation is obtained without the least disturbance of the power-factor or wave-shape of the system.

For Varying the Direct Voltage

The shunt wound synchronous converter with induction regulator also provides a very successful combination for varying the direct voltage and has been largely employed by the big lighting companies. The variation in the direct voltage is obtained by varying the voltage impressed on the collector rings of the converter. The induction regulator is a special type of transformer in which the secondary is connected in series with the line and the primary across the line and resembles the wound rotor induction motor in construction. The change in alternating current voltage is obtained by turning the movable primary through 180 electrical degrees.

With regard to the starting up of synchronous converters, this is now done almost invariably from the alternating current side. This method is self synchronizing, requires the shortest possible time for starting a machine, and at times of emergency it minimizes the liability of confusion and mistakes by operators.

In order to prevent a heavy rush of current at starting, it is necessary to reduce the potential. This is done by providing starting taps in the transformer secondaries. The current in the armature induces a magnetic field in the pole pieces, and as the iron has hysteresis, the induced field lags behind the current producing it, thus creating a torque. Half voltage taps are used in starting 3 phase converters, and one-third and two-third taps with 6 phase converters.

When starting up in this manner, the armature winding stands in relation to the field winding as the primary of a stationary transformer to the secondary. The large number of turns in the field spools compared with the turns in the armature will produce in the field winding a high induced electro-motive force which must be kept within safe limits. This is done by breaking up the field circuit between the spools by means of a switch provided for that purpose on the frame of the machine. The procedure in starting up, therefore, is as follows:

After seeing that all the machine switches are open (and with commutating pole converters, that the brushes are raised), the high tension oil switch is closed. Then the starting switch is closed and the rotary will start up running on one-half or one-third normal voltage as the case may be. As the speed of the machine increases, the voltmeter connected across the direct current side will oscillate back and

forth and finally come to rest in either a positive or a reverse direction, that is, the machine may come up to synchronism with either positive or negative polarity. For this reason, the field break up switch is made double throw and this switch is thrown in the normal position if the machine builds up positive. If, however, the voltmeter shows that the polarity of the converter is reversed, the field switch is closed in the other direction, reversing the current through the field coils.

The flux set up by this reversed current in the field coils opposes and overcomes the flux induced by the alternating current flowing in the armature, causing the armature to drop in speed till it slips a pole, and when the potential at the brushes is brought to zero, there is no field current and the polarity reverses. If the field switch is now opened the converter will run in synchronism and the field switch is thrown to its original position, after which the converter is thrown on the full voltage tap, or if 6 phase on the two-third and full voltage taps successively. If the converter has commutating poles, the brushes have been lifted and they are now lowered, the shunt field rheostat is adjusted and the converter is ready to be thrown in on the line.

This method of starting from taps on the step-down transformers is the simplest and cheapest, as no separate starting motor, or external source of direct current has to be provided. The trouble of synchronizing and the danger resulting from throwing in machines when not in synchronism is also avoided.

From the foregoing, the wide range of service for which the synchronous converter in one of its present forms is eminently suitable, is apparent; and it can to-day successfully operate under conditions that a few years ago could have only been met by the motor-generator.

Vancouver on Lookout for Power Propositions—Cheap Power and Cheap Sites are Essential for Attraction of New Industries

The crying need of Vancouver is new industries to supplement the sawmills in furnishing a stable pay-roll, but so far the answer to the cry has been far from satisfactory. It is a well-known fact that a number of Eastern manufacturers have visited Vancouver during the past three years with the intention of arranging for the opening of branch factories. Knowledge of these facts recently stirred a number of Vancouver aldermen to consideration of a cheaper power supply, the matter being placed in the hands of the civic fire and police committee, which body has already been offered three hydro-electric power sites. No. 1 is located on the Cheakamus River, sixteen miles north of Squamish, Howe Sound; No. 2, on the Indian River, at the head of the North Arm of Burrard Inlet; No. 3, on the Bridge River, ten miles west of Lillooet.

The Cheakamus River site was offered by Mr. H. K. Dutcher and Mr. A. W. V. Innes, solicitor. It was held by the B. C. Power and Electric Co. Its main features were 55 miles from the city, horsepower available 100,000; cost of development $52 to $80 per horsepower; total cost from $2,662,000 to $3,930,000.

Mr. W. R. Bonnycastle offered the other two propositions in a letter to the committee. The Indian River one was 25 miles from the city. In one plant 40,000 horsepower could be developed, he said, at a cost of $60 at the switchboard or $80 delivered in the city.

The second site was that at Seaton Lake, 150 miles from the city, where there was 200,000 horsepower available at a development cost of $35 a horsepower at the switchboard or $65 delivered. The available power could be increased to 400,000 horsepower.

Ald. Kirk moved that the city engineer report on the power possibilities of Seymour and Capilano creeks. Another resolution was put through by Ald. Gale that the city solicitor be asked to report on the right of the city to supply light and power to residents of the city and adjacent municipalities before the expiration of the B. C. Electric franchise.

B. C. Water Powers Can Develop 3,000,000 H.P.

In connection with the above subject the following excerpts from an address delivered recently by Mr. George Kidd, general manager of the British Columbia Electric Company before the American Club, Vancouver, may be found interesting:

"Engineers in the course of their surveys in British Columbia find the water powers of this province are capable of developing 3,000,000 horsepower. Of this amount the British Columbia Electric has about half, or 120,000 horsepower. On the mainland the Lake Buntzen plants represent a development of 85,000 horsepower, while hydro-electric plants on Vancouver Island belonging to the company have a capacity of 32,000 horsepower. In addition the company has two steam plants for use in case of emergency which are capable of generating 27,000 h.p. There is probably no city in the Dominion with such energy available for the development of industry. Despite assertions to the contrary, power for industrial purposes is being sold here as cheaply as in any city of the Dominion, and cheaper than in many cities on the Pacific Coast.

"The great expense is in the development of these power-producing plants. His company had spent some $15,000,000 in this work. To produce one horsepower per year it is necessary to make a capital expenditure of from $60 to $150. Because of this large initial outlay no company can afford to sell the power for a merely nominal rate.

"British Columbia is exceptionally fortunate in natural advantages for the development of an industrial community. But such industrial development also depended upon the provision of markets, availability of industrial sites at reasonable values and an adequate supply of labor at a reasonable price. The existing depression is only partially caused by the war. A period of such remarkable prosperity as this province enjoyed must unavoidably be followed by a reaction. Money then came so easily that we forgot the economic rule that real commercial value of any property consists in its power to produce revenue. Forgetting this led to the creation of fictitious values, impossible charges in the form of rent and interest.

"But I am no pessimist. I feel sure that this province will come back to her own and that after the war a large immigration from the Old Country will come here. It is for the people now here to keep established concerns going during the present depression, to encourage in every way the investment of capital in industrial lines and to see that capital coming here is wisely spent and fully and fairly protected. If this is done the province will enter upon a new era of prosperity having a much sounder economic basis than has existed in the past."

On August 31st the ratepayers of Outremont, P. Q., will be asked to vote on a by-law establishing civic plants for private and public electric lighting and also for the necessary distribution system. Any net profits of the private service are to be applied to the reduction of the annual charges for capital and interest on the plant and distribution system for public lighting. The cost of the establishment and maintenance of the public service will be paid by the proprietors of real estate bordering on the streets lighted, by a special annual assessment, this amount to be fixed annually by the Council. The total amount so chargeable is to be one per cent. of the capital outlay, together with interest not exceeding 6 per cent.

Electric Railways

For Suburban Traffic

The McKeen Motor Car Company, Omaha, Nebraska, have just worked out a new type of gasoline operated passenger car known as the "Highway Coach." It is intended to run on paved or macadam streets and is claimed to be the most comfortable and luxurious car that has ever been placed on the market for this particular service. In length

The McKeen "Highway Coach."

the new car is 25 ft. 6 ins.; wheelbase 216 ins.; approximate weight 10,500 pounds.

The accompanying illustrations show the exterior and interior of this car. The windows are plate glass, airtight, dust-tight, and round, affording an almost uninterrupted view in all directions. The window when open, as shown, is secured to the ceiling. Exhaust suction ventilators placed in the roof maintain a constant circulation. The interior of the car is finished in Cuban mahogany. The lighting is

Interior coach,—individual chairs, windows suspended.

electric and between each pair of windows a push button is supplied for convenience in signalling the driver. The entrance and exit doors are controlled by the driver. Adequate heating facilities are obtained from the waste product of the gasoline engine. Passengers enter the car at the curb, thereby avoiding conjested and street traffic. A special feature is made of the individual chairs. The seat is a shock absorbing, cushioned chair and is claimed to be unusually easy riding. The car has a seating capacity for twenty-seven persons.

Lavatory Accommodation on Interurban Lines

The question of lavatory accommodation on suburban and interurban electric railway lines has been receiving the attention of the Board of Railway Commissioners who recently issued a circular to Canadian electric railway companies on the subject. Among the replies received that of Mr. E. P. Coleman, general manager of the Dominion Power and Transmission Company, which controls the Hamilton city lines and the suburban and interurban lines in that vicinity, covers the situation very fully, and we believe fairly. Lavatory accommodation in travelling coaches is at best an objectionable convenience and, as such, should only be provided where the need is urgent and the demand practically unanimous. After citing the conditions on their various lines Mr. Coleman sums up the situation as follows:—

As all cars are habitually interchanged between these railways, the installation of lavatories on any of them would compel their use on all, and while we are willing and anxious to provide all necessary or desirable accommodation for the comfort and convenience of our patrons we are firmly of the opinion that accommodation of this nature is unnecessary and unwise, principally for the following reasons, viz.:—

"Electric railway traffic is generally of a different nature to that obtaining on steam railways, as it is mainly confined to local patrons who are never far from their own homes or the convenience of their hotels or offices, and the short time spent on electric cars comes more in the category of the cab ride or the walk between office and home than in the case of the traveller who settles down for a journey of some distance on the larger railway lines.

"An electric car is usually smaller than the standard steam railway car, is more likely to be crowded, on account of the fact that single car units are used, and the problem of ventilation under the best of conditions is a serious one. Lavatories, when installed, are necessarily placed in a conspicuous position near the centre of the car, and among the passengers, and our observation has convinced us that it is impossible to prevent a disagreeable odor throughout the car from their use.

"The conspicuous location of the lavatories above referred to has a tendency to discourage ladies and the better class of passengers from taking advantage of the accommodation and their use will be generally confined to the rougher class of men, particularly those partially under the influence of intoxicating liquor, who will neglect the terminal

accommodations and use those on the cars, many times in a manner which will be offensive to other passengers. That this is a serious objection to car lavatories is proved by the great difficulty that we have in keeping our terminal lavatories in a decent condition, even with an attendant always on duty.

"Electric cars are not confined to a private right of way, but must of necessity occupy thickly settled streets for a very considerable portion of the time and, with the best of care, a vehicle of this description, when provided with a lavatory, will at times become a carrier of the best imaginable type for the distribution of disease germs.

"As electric railway terminals and yards are, from the nature of the traffic, invariably located in the most congested and busiest portions of the communities which they serve, the cleaning of cars and disposal of the sweepings and waste water is always a serious problem, and it will be readily perceived that the cleaning of lavatories in these yards without danger to public health is practically impossible. Under the best of conditions, and even if proper sewer connections can be arranged, constant cleaning of accommodations of this description will inevitably create a condition of the station and surroundings which will in time become a public nuisance.

"The use of car lavatories is not a common practice even on electric railways of large mileage, and the fact that some lines have thoughtlessly adopted their use, apparently from a desire to become as much like a steam railway as possible, should not be accepted as a convincing argument in favor of forcing them upon electric lines of the nature and extent of those operated by this company and generally throughout the Dominion. It is our opinion that the safest and best method to adopt in the interest of public health and safety, as well as for the convenience of the patrons of electric railways as a whole, is to establish proper stationary lavatories at the terminals and at convenient points along the line for the use of patrons who may be constrained by necessity, and at which cars may be held or stopover checks issued."

The following extracts from a recent report of Mr. James Ogilvie, mechanical expert of the Board of Railway Commissioners, on the same subject, further indicates the general sentiment on this question:—

"From interviews which I had with the managers and other officers of the various railway companies which I visited, they are very much opposed to the idea of providing lavatory accommodation, owing to the fact that their systems run through and in and out of cities and through quite a number of villages. Some of them stated they had already tried it in some of their cars and had taken them out on account of its being a nuisance and source of annoyance. The Ontario Railway and Municipal Board has taken this matter up with the Hamilton, Grimsby & Beamsville Railway management, and has asked it to provide the accommodation above referred to, but I understand from the management that the people along the route have very decided objections to the installing of lavatories in the cars, owing to the fact that the railways in a great many instances runs along in front of their residences and is located close to the sidewalk. While there is no doubt that the accommodation above referred to might be beneficial, I am afraid it would also prove a considerable nuisance, if it was made compulsory for all cars to be equipped with accommodation of this nature. If, on the other hand, it is deemed necessary, I would recommend that the matter be taken up with the management of the various electric roads under the Board's jurisdiction, and that they be asked to file a statement showing the number of cars on the various runs with lavatory accommodation, if any, also to file their objections, if any, to providing this accommodation on all their suburban cars, or runs of 15 miles or over."

Calgary Railway Men are Generous

The employees of the Municipal Electric Railway System of the city of Calgary have set a good example in subscribing the funds necessary to purchase a machine gun which, along with a number of others subscribed by various organizations in and around Calgary, will accompany the 56th battalion. Mr. G. M. Thompson of the Calgary News-Telegram acted as trustee of the machine gun fund, in which paper the following comment appeared on the occasion of the receipt of the $800:—

That the street railway men at home do not forget the needs of their brothers in arms for Britain and Canada is plainly evidenced by the receipt today by The News-Telegram of a cheque for the sum of $800 from the employees of the Calgary Municipal Railway, with which to purchase a machine gun for the 56th Battalion.

This contribution, which is more than could reasonably be expected from these men at this time, has been raised from the employees of the Calgary Street Railway under the auspices of the Calgary Municipal Railway Social, Insurance and Sick Benefit Association, and almost every man on the system came forward with his mite on behalf of the good cause. In these days, when the street railway men are working, in many cases, on short time, and upon a reduced schedule, the self-sacrificing example of these employees is one which will commend itself to the general public, and is such as could well be followed by some citizens in more remunerative and more affluent walks of life. Many of the former colleagues of the street railway men are wearing the King's uniform, especially in the 56th Battalion, and when the subject of a machine gun was mentioned, they took up the task with a will, and the splendid results of their efforts shows that, even under somewhat adverse circumstances, these men are not above making a sacrifice for their brothers who have enlisted for the front. The campaign for funds was carried on by a committee of the men, and it is to their credit to say that but few refusals were met. The employees as a whole are highly gratified by the results, and none of them is better pleased than Supt. McCauley, who feels especially proud that "his boys," as he calls them, never fail to rise to the occasion when necessity appears to demand it.

Gun for the 56th Battalion

The following letter accompanied the contribution, for which The News-Telegram desires to publicly thank the street railway men for their self-sacrifice and public spirit:

Calgary, Alta., August 13, 1915.

Mr. G. M. Thompson, .
Trustee Machine Gun Fund,
Calgary News-Telegram:

Dear Sir,—On behalf of the Employees of the Calgary Municipal Railway, under the auspices of the Calgary Municipal Railway Social, Insurance and Sick Benefit Association, I beg to enclose you a cheque for Eight Hundred Dollars ($800.00) for the purchase of a Machine Gun, and if it could be conveniently arranged, the above-mentioned employees would like this gun to go to the 56th Battalion, under Col. Armstrong. Yours truly,

Jno. Fazackerly, Sec.-Treas.

Personal

Mr. E. S. M. Macnab, recently electrical foreman of the car department at the Angus shops of the Canadian Pacific Railway Company and car lighting inspector for the same company, has been appointed engineer of electric car lighting.

Questions at issue between the B. C. E. R. Company and their employees are being submitted to a board of arbitrators. Mr. J. A. Harvey, K.C., is acting for the company and Mr. E. H. Morrison for the men. The British Columbia Government appoints a third arbitrator.

The Dealer and Contractor

A Plan that Wired 250 Houses

The Minneapolis General Electric Company has developed an exceedingly interesting premium plan to assist in the closing of contracts for the wiring of old houses, the following description of which appears in a current issue of the Electrical World. The idea was first put into effect last summer and resulted in practically doubling the number of houses wired during the four summer months as compared with corresponding figures for the year before. The plan was a simple one in which the company offered a premium to every customer whose co-operation was instrumental in the securing of a house-wiring contract, the character of the premium—that is, the appliance given—being dependent upon the size of the contract given.

The Influence of the Premium

The offer was given wide publicity through the company's newspaper advertising, and response was prompt and far more effective than had been expected. It virtually resulted in enlisting as an active selling agency the aid of countless consumers who sought every opportunity to interest their friends and acquaintances in modern applications of electric service in the home. The company did not suggest that these volunteer agents make any effort directly to secure an order or close a contract, their function being to spread the influence of their own experience and enthusiasm and to notify the company whenever, in their opinion, the way was sufficiently prepared for a call from a regular salesman representing the company.

As the sales manager of the company states: "The customers use all the arguments with which they are acquainted from personal experience to persuade prospective customers to take the company's service in order that they may themselves receive their premiums." When the contract is closed the customer who has influenced the sale receives his choice of a number of premiums, the value of which depends upon the size of the contract.

No hard and fast rules were followed in utilizing the services of these customer-salespeople, after a prospective customer was reported, but naturally the regular salesman used the name of the customer for introductory purposes. Also, where it was found that a bit of assistance could be rendered by this customer, there was no hesitation in calling for it, and in most cases the response was willing. It was expected that among the names suggested in this competition there would be a considerable number not well supported with missionary work actually done by the customer, and that there would be a certain number of improper applications for premiums, but the campaign was conspicuously free from incidents of this kind.

The First Experiment with This Selling Plan

The first premium offer went into effect on June 1, 1914, and was in force throughout the month of September. The accompanying table gives interesting figures on the number of houses wired during those months, as compared with corresponding months of the year before. From the beginning of the year to the first of June, it will be noted, there was an increase of 23 per cent. in the number of old houses wired over the same period in the previous year. This is taken as the natural increase, which would have been expected if no additional effort had been made to interest this class of business. Since other conditions were the same as during the previous year, the company believes all increase over 23 per cent. effected during the campaign to be due to this premium offer entirely. The total gain over the four months' period figured 71 per cent., or more than 250 houses wired, which, by the way, is between two and three houses wired per working day as the result of premiums.

In commenting on the campaign, the sales manager writes: "We, of course, have no actual, direct proof that a customer received in this way will in turn secure a premium for himself by giving us the name of another 'prospect' who will become a customer, but there is little doubt in my mind that this system has a wonderfully cumulative effect. The greater number of the applications are from women, and I will say that they make very good missionaries—these women customers of ours working for premiums."

Table Showing Comparative Number of Old Houses Wired During Corresponding Months of 1913-1914.

	Old Houses Wired, 1913	Old Houses Wired, 1914	Percentage of Increase
January 1—May 28	359	442	23
June	104	153	47
July	92	149	62
August	82	150	63
September	75	233	210
Total for campaign period	353	685	94

Offering Premiums for "Prospects" Only

A further application of the premium plan has just been successfully made in Minneapolis through a one-day premium campaign. In this instance a toaster was offered to any customer who would send the company the name of an acquaintance or a friend at that time living in an unwired house which had been built for at least one year and, of course, situated along the company's lines, provided only that this name had not already been contributed by another customer. This offer did not entail any missionary work on the part of the customer, and it was not necessary for him to await the outcome of the company's own selling effort before the prize was given. In this one-day campaign all that was required of the customer was to present the name of a qualified "prospect" for house wiring, and the toaster was freely given. About 300 toasters were issued

on this day, and the names of more than 1,000 "prospects" were received.

Most of the contestants supplied more than one name, some of them offering as many as fifteen or twenty names, to make sure that they were complying with all the conditions. Many gave a few names over the telephone and stated that they would follow this in the mail with a longer list, which they did—lists coming in for several days thereafter. Not enough time has elapsed for sufficiently working over this list of "prospects" to find out how many contracts out of the number will be closed; but the benefits which have already been derived, together with results in view, satisfy the company that the offer was entirely profitable. The toasters which were given away were some which cost only about $1 each. They had been left over from a campaign which was conducted during the Christmas holidays, and, as a matter of fact, the company had been seriously wondering how it was going to get rid of this particular lot of toasters.

The sales manager of the company writes: "The 1,000 names of 'prospects,' of course, afforded us a valuable mailing list as well as a list for the salesmen to work on, but not least in importance is the fact that the 300 successful applicants provide a corps of 300 'live' salesmen, or rather saleswomen, as virtually every applicant was a woman. The fact that these 300 persons obtained premiums is evidence that they were 'live wires,' and we are making good use of them.

"Another very surprising fact in connection with the applicants for premiums was the class of people who applied. Of course, everyone wants something for nothing, and this is not limited by any means to the poorer class. We found that the better-off class of people are just as desirous of getting something for nothing. The great majority of applicants were from among the more intelligent and prosperous class, many of them being well-to-do people."

The experience in Minneapolis is an interesting evidence of the worth of any artifice that serves to win the attentive interest of present customers. No one can do so much for the public-service company as the consumer who will spread enthusiastic testimonials, and if this invaluable co-operation can be invoked by the bestowal of inexpensive toasters, here is an opportunity that every central station might well take advantage of. For every toaster given away will soon pay back its cost in additional energy consumption.

Business Hints for Dealer and Contractor*

One of the troubles connected with the flash-lamp business, which isn't a trouble at all if the dealer uses a little common sense in connection with it, is handling the battery stock so as to keep it efficient. A good many retailers have complained that their customers return the batteries for adjustment because they have not received reasonable service out of them, and in most cases the dealers are inclined to blame it on the customer.

It very often happens, however, that the dealer himself is at fault, because he does not keep his batteries moving. In other words, he should sell his oldest batteries first, so that the possibility of deterioration, which is always going on in dry-cell batteries, will be minimized. Sometimes it is found that a dealer, largely from force of habit, will put his fresh stock of batteries at the front of the shelf, and sell from this, when as a matter of fact he should be putting the new goods at the back, and selling from the front, where the older stock has been placed.

This condition emphasizes the point that the dealer should keep only a small stock of batteries on hand, and should turn over his stock frequently. That is good business policy in any event, but it is especially desirable in connection with batteries, on account of the deterioration to which they are subject. One of the biggest jobbing houses in the Central West, which sells thousands of batteries a year for use in flash lamps, frequently bulletins its salesmen and dealers on this subject, emphasizing the idea that it is far better to have a small stock, and keep it moving, than to put in a big stock and run the risk of having customers bring back worn-out batteries and demand replacement.

Some of the battery manufacturers are now stamping the packages with the dates on which their guarantees expire, and this is hastening sales, by making the dealer use his oldest stock first. At the same time it is making it a good plan for jobbers to have goods delivered by wire and express arrangements, instead of laying in a big stock, delivered in the usual way by freight.

*By G. D. Crain Jr. in Electrical Review.

Another angle on the proposition is that since the most profitable part of the flash-lamp business is the replacement of batteries, it is important that the customer be satisfied with his battery service, else he will discontinue using the lamp. If the dealer will take care of this feature there will be no trouble about batteries going dead in short order, except in infrequent cases where a short-circuit has been introduced through some fault of the user.

Testing Electric Fans

In spite of the fact that a great many dealers are convinced that the only thing which will sell a fan is the lowest price quoted in the market, the service feature is still an important one, and the dealer who is prepared to render service, or, better still, anticipate the requirements of his customers to an extent that makes service after the sale unnecessary, has the edge when it comes to competition .

Every fan which goes out of a store ought to be fully tested before it is delivered. In this way the dealer will be able to locate defects, if there are any, and thus avoid having to go to the trouble and expense of replacements. On the other hand, there are fans and fans, and many of them have individual peculiarities which need attention and study. For instance, some light oscillating fans will not start if tilted at an extreme angle. Where this is the case the customer should be given to understand that the fan must be standing on a level when it is started. Other fans require connection to be broken entirely in changing from one phase to another. If this is not done the fan stops. If the fan is tested before being sent out of the store, excessive noise, possibly due to lack of oil, trouble in the commutator, or whatnot, can be noted, and the fan put in good condition before being delivered.

The dealer who reads this may think that too much work and trouble are involved to justify the effort along the lines of testing for defects, but such a policy will pay in the satisfaction of customers, and in time saved after the fans have been put in service. You can't get away from making good the defects of the goods you sell, no matter how much you

may want to do so; that is if you expect to stay in the business.

Automobile Lamp Sales

Becoming "headquarters" for a certain article is largely the result of using publicity in connection with it.

A dealer in a certain large city has got a lot of business from garages, automobile owners and others connected with the motor-car business, simply because he has taken pains from time to time to advertise the fact that he carries a large and complete assortment of automobile lamps. At times he has put on a special sale of tungstens for autos, pricing them attractively so as to get the interest and attention of owners and others.

This effort has paid in the business which has been created directly, and it has also paid, because it has given the dealer a reputation along that line. Owners are often sent to the store by garage men who do not handle lamps and prefer that the purchase be made directly instead of handling it themselves.

Of course, bulbs for autos do not cost much, and the possible business may be limited, but the point is that any article that is featured is going to be sold, and that the dealer who is live enough to hook himself up with the present and potential demand for electrical specialties is going to be remembered when consumers are in the market for those particular goods.

Meetings of the Salesmen

A successful electrical concern, which handles merchandise and contracting as well, has regular meetings of its force, the get-together affairs coming at least once a month, and sometimes oftener. Among other things it is the object of the organization to familiarize the force with the new goods that are put in stock. The theory of the head of the business is that if the salesmen are not interested in a line the customers can't be expected to show any great amount of excitement over it; and, on the other hand, that the salesmen won't be interested unless their interest has been aroused by learning something about it.

Hence at these meetings every article which has been put in stock recently is discussed, and all the various selling points brought out. Discussion of the price, with reference to competition from other lines, is included, and when the subject is dismissed everyone present has a good grasp of the proposition, and is in a position to talk that article effectively to anyone who may inquire about it. If the salesman of the manufacturer happens to be in town when the meeting is held he is invited to attend, and invariably fills the boys up with technical data about the proposition, as well as material which can be used in sales work.

In addition to discussing goods that are actually in stock the members of the organization bring up articles which have just been put on the market. The head of the house asks their opinion of new goods with a double purpose: first, to learn whether the salesmen have discovered any advance demand for the article, and, second, to give an opportunity to "post" them in advance of its being put in stock. One discussion of that sort early this year resulted in a certain popular-priced fan being put on sale, and the store has done well with it, in spite of weather conditions not being altogether favorable.

Money in Fan Sales?

Local conditions often determine the question of profits in the sale of fans. If there happens to be an aggressive dealer of the sort who puts volume before profits, the chances are that prices will be reduced to a point which will not permit the dealer to get out with a whole skin. On the other hand, if the members of the trade are sensible enough to realize that they have got to have a reasonable margin on which to do business, and that no volume, however large, will make up for lack of profit on individual sales, everybody will have a chance to make a little money, and even the dealer who handles only a few fans during the season will have an opportunity to put a few dollars on the right side of the ledger.

In a certain city, where the dealers know the situation well enough to have realized the folly of price-cutting, they have failed to make money this season for the first time in several pears. Up to this year everybody has tried to maintain prices. Somebody apparently had an idea that it was possible to make a "killing" on fans, however, and bought in sufficient quantity to get an "extra epecial" inside price. Then he went out to sell fans when the season opened, and quoted a price which was, on an average, 20 per cent. below the figures of last year. Others had to fall in line, with the result that profits have been a minus quantity. In fact, considering the cost of selling them, the dealers have all lost money on their fan sales, and more than one has been talking of dropping the business hereafter.

The fan trade is growing, and is the biggest electrical proposition on the boards in the summer time. The dealers who are handling them have got to use a little horse sense, however, and keep the prices at a profitable level, remembering that a cut price seldom creates business. The most it can do is to divert it from somebody else, and with everybody cutting the advantage is negatived.

Suggestions for Business Success*

I believe the qualities necessary for success in the electrical contracting business are honesty, sincerity, and efficiency.

Be honest with everyone, especially those who are in your employ and with those with whom you deal. Any customer good enough to give you one dollars' worth of business or less is worthy of your fullest consideration.

Be sincere by carrying on your business with the best business methods you can find. Join all business organizations whose purposes are for the uplifting and betterment of your profession (business). Every city has a chamber of commerce, building exchange, trade associations (local and national) to which men engaged in the different lines are admitted to membership. And so have we who are engaged in the electrical business kindred associations. If the business men of your community find it to their advantage to join such organizations and by doing so elevate the community standing in the business world, then it is proper that you, also, join these associations.

You may imagine success to be a very difficult problem, yet if you will only investigate you will find it to be a simple proposition. To do this you must learn your cost and overhead. To arrive at the cost when we are figuring a job we use a tabulation sheet. This sheet is used in "taking off" every kind of a job. It is one which we can easily change to fit all jobs. The features of our tabulation sheet are: It enables us to get a complete list of all outlets with fittings

*By W. C. Harrington, in National Electrical Contractor

to be used on each outlet. It gives us a column where we may list all outlets on brick walls, making it easy to figure the channeling of brick walls, also conduit to be used on brick walls and the additional labor for same. The space for the different sizes of conduit gives us a column to tabulate the number of feet on each horizontal run, also the number of feet in all vertical runs in each circuit. Every circuit is "taken off" separately, and when the job has been measured it is only a simple matter of addition to get the exact quantities.

Wiring for all feeders to tablet boards, to motors, vacuum cleaner systems, telephone system, watchman time clock system, fire alarms, bells, annunciators, etc., should be taken off separately in the same manner as we have outlined above for the branch circuits. In taking off the large mains, motor, etc., I find it a splendid help to first draw up a wiring diagram on plain white paper, then to measure each run separate, making a record of same, and from these sheets make up separate estimate sheets.

The estimate sheet is one whereby each and every item of material and labor can be listed and should be listed and priced in the same manner as you would require your bookkeeper to make an invoice of said job if it was to be billed out as a time and material job.

There is only one way to be successful, and that is, you must learn the cost of doing business, and this can be learned by taking an inventory and getting out frequent financial statements. You will find many books on the market in which you may read volumes on overhead expenses and cost of doing business, but the simplest thing to do would be for you to figure out your own cost. Every business man knows what he pays for rent, telephone, office hire and his own salary, stationery, organization dues, postage, liability, insurance, taxes, and all such accounts which go towards making up costs, and then by taking the amount of business which you have done for a certain period you can easily find your overhead cost.

Every contractor should make a certain percentage of profit over and above his cost of doing business. This is a recognized right and no one wishes to deny you the privilege of making a fair and reasonable profit.

My advice is not to guess at anything or be afraid to charge one dollar for the things that are worth one hundred cents.

Don't be afraid to charge your overhead expense when you figure all jobs. Show it on your estimate sheet.

Don't be afraid to charge your overhead expense when you do percentage jobs.

Don't be afraid to charge your overhead expense when you do time and material jobs.

Overhead expenses are, without a question, just as much a cost on all jobs as any other item.

Pay yourself a salary equal to what you would expect to receive working for someone else. You certainly are worth more than a journeyman in your employ, because you are expected to know more, and, besides, you work longer hours.

Live and let live! Remember, you cannot get all the electrical work in your community; neither can your competitor. Both of you can get your share of the business. Therefore, it is only the correct thing that all of us remain friends, and members of our National Electrical Contractors' Association.

Instead of endeavoring to do a greater amount of business each succeeding year, you should set out with a determination that, instead of a volume of business, it will be profits. If this would be a rule there would not be so many electrical failures each year. I could never admire the man who was always talking about the volume of business he was doing, regardless of profit; neither could I admire the contractor who would take a job at a low price to keep someone else from getting it who might have made a profit; nor the contractor who would take an original job at a low price so that he could be in a position to rob the owner with high prices for all changes in work and extras. On the other hand, I hold with admiration the man who (no matter how small a business he does) shows by his standing in the community that he is honest, sincere and efficient; also making profits equal to what is made by men engaged in other lines with the same amount of investment as is necessary to carry on an electrical business.

I am fully convinced that the electrical business is one where the men who are engaged in it are justly entitled to a reasonable profit. I also believe that many who submit bids on work make mistakes in not properly "taking off" their jobs carefully in the first place. Therefore, I believe that more attention should be paid by all estimators in listing the little items on estimate sheets where they can be carefully priced. Do not try to be the cheapest bidder on the job. It has been the cheapest bidders in the past who have never made a success of the business or a reputation for themselves. You have heard many of these arguments before. The question is how many of you to-day have the conviction to carry out these principles? In truth, they are nothing more than true business principles adopted by the majority of successful men doing business to-day in this or any other country.

Another reason for attending the Contractors Convention

In connection with the coming Toronto convention of electrical contractors a fine display of equipment of manufacturers and jobbers will be held in the convention rooms, corner Yonge and College Streets. The jobbers recognize this as an excellent opportunity to get in touch with their customers, and the following firms have already signified their intention of exhibiting; further requests for space are coming in, so that the committee having this matter in charge expect to have all available space filled:—Canadian General Electric Co. Ltd., Factory Products Ltd., Flexible Conduit Co., The Metropolitan Engineering Co., The Northern Electric Co. Ltd., The Norton Telephone Mfg. Co., P. N. Wettlaufer.

Don't forget the date—September 6, 7, 8.

A Prosperous Jobbing House

The Premier Electric Company, Limited, is one of the most recent electrical jobbing houses established in Montreal, having opened offices and showrooms at 74 Victoria Square in June last. We are informed that the company have done an increasing business from the commencement, in spite of the general commercial set-back. They have several lines of exclusive specialties, the more important being moving picture carbons, tungsten and nitro lamps, irons and toasters, inside and outside fixtures for either tungsten or nitro lamps, special ship fittings and fittings for dock, harbor, railway station, freight yard lighting, etc.; in addition they carry a line of usual wireman's supplies. The majority of the lines carried by the company are of Canadian and British manufacture. In addition to cultivating the home trade this company are also building up an export trade with encouraging success and invite the co-operation of manufacturers (not necessarily electrical only) who are desirous of increasing their export trade. The managing director of the company is Mr. H. N. Howlett, who has had a wide experience in the electrical trade, and who has a considerable knowledge of the export branch to all parts of the world, including Great Britain and Europe.

An Electric Cooking Demonstration

On July 26th, and continuing until August 7th, the Public Utilities Commission of the city of Port Arthur gave a demonstration on the ground floor of the Whalen Block, of cooking by electricity, and also an exhibit of everything electrical imaginable. The great cry of "Do it electrically" was well maintained, and the excellent support given by the local dealers made this demonstration a success from the first.

A splendid display was given by A. C. Waltz & Company, of the National ranges, and the Hughes Electric Company showed all their new style ranges. The Commission, knowing that the public are rather difficult to interest in anything new, hit upon the plan of having the ladies' societies in connection with the different churches, etc., etc., give bake sales daily. They supplied the societies with the use of all the stoves and a capable cook demonstrator. Afternoon tea was served to the visitors daily. The city band was in attendance on the opening night and music was provided at all times.

Much interest was shown in the different styles of electric water heaters.

The Commission have arranged to give a special rate for cooking of 1½ cents per kw.h. and since the demonstration the dealers have informed them that excellent results are being obtained both from the cheap rate, and more especially on account of the demonstration.

Very pretty displays were made by the Quaker Oats Company, the Robin Hood Flour Mills and the Crescent Manufacturing Company, the latter displaying "Mapleine" for cooking purposes. This was used extensively during the demonstration in the making of candies by the Mapleine demonstrator, and gave good results.

The following firms were among the exhibitors:—The Canadian Westinghouse Company, showing the Canadian Westinghouse range, operating Copeman patents. Mahon Bros., exhibiting Hughes Electric ranges. A. C. Waltz & Company, "Made in Canada" National ranges. Canadian General Electric Company showing their own range. Star Electric Company exhibiting many little novelties, such as attachment motor for sewing machine, vibrators, fixtures, etc. The Hughes Electric Company sent a demonstrator from Chicago with good selling results for their ranges. The demonstration proved such a success that it is the commission's intention to repeat on a larger scale in the spring.

A Useful Sales Help

One of the first questions the average householder asks when a salesman tries to sell an electrical device is, "How much will it cost to operate?" A well-known retailer has installed in his showroom a device that will answer this question in a way that instantly attracts a customer. He has had a 7-inch Westinghouse switchboard type single-phase indicating wattmeter mounted on a small plate panel above a lamp socket, and both connected to their lines. The wattmeter has a black dial with white figures and pointer to make the readings stand out clearly, and has been calibrated in "cents per hour" instead of watts, based, of course, on the cost per kw.h. in this locality. Any heating device can be attached to this circuit, and the prospective customer gets an ocular demonstration of the cost of the operation.

High Tension Switches

The Delta-Star Electric Company, Chicago, are distributing descriptive leaflet 750, showing typical installations of high tension air break switches of various commercial voltages up to 66,000.

Winnipeg Fire Alarm System

The August 1 issue of the Electrical News contained a description of the present up-to-date fire alarm system in the city of Winnipeg. The article should have stated that the central office apparatus was manufactured by the Gamewell Company, and was supplied and erected by the Northern Electric Company, Limited, of Montreal and Winnipeg.

Display of Electric Devices at Port Arthur Municipal Demonstration.

What is New in Electrical Equipment

The Jumbo Electric Iron

A clever way of boosting central station service, and advertising electric heating appliances, while aiding in the success of a local celebration, has been demonstrated by the Wilmington and Philadelphia Traction Company, of Wilmington, Delaware. The occasion was an Old Home Week, among the special features of which was an industrial pageant. At about the same time the company was making a

special campaign on Westinghouse electric irons. This suggested the idea of building a float to represent a large electric iron. It was mounted on the chasses of a small electric runabout, ordinarily used by one of the company's trouble men. The Wilmington and Philadelphia Traction Company had three floats in the parade, of which the monster electric iron attracted the most attention on account of its unusual appearance. This float was the subject of a great deal of favorable comment, and the company received a number of compliments from city officials as well as from the committee in charge of the parade, for the originality shown. The pageant was witnessed by a crowd of 30,000 and while no figures are available to show the number of sales resulting directly from this display, the company is confident that the expense was more than justified.

Connectors for Armored Cable and Flexible Metallic Conduit

A new device for connecting steel armored cable or flexible metallic conduit to switch boxes and outlet boxes has recently made its appearance. This is made in two forms, of which Fig. 1 shows the connector for loom switch boxes. This type of connector is made of sheet steel of sufficiently heavy gauge to withstand any strains to which it may be subjected. This stamped sheet steel is bent into the form shown. The neck of the device is made to fit into the knockout of all standard loom switch boxes. It has a smaller diameter than the rest of the device so as to form a shoulder on the inside of the box for the conduit or cable. The inner edge of this neck is rounded off to form a smooth entrance bushing for the wire. The open side of the connector is doubly split so as to form two pairs of ears. The inner set of ears provides a means of expanding the neck of the collar so that it fits firmly in the knockout of the box; this is done by tightening the screw against the unperforated ear. The other pair of ears at the outer edge provides a means for clamping the armored cable or flexible conduit by being drawn tightly about the same by means of clamping screw.

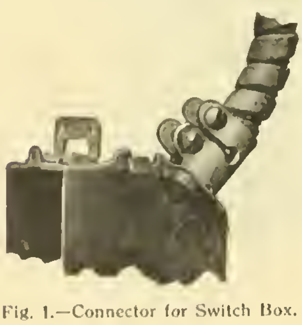


Fig. 1.—Connector for Switch Box.

Fig. 2.—Connector for Outlet Box.

The connector shown in Fig. 2 is adapted for securing armored cable or flexible steel conduit to standard outlet boxes. The general principle of this connector is the same as that in Fig. 1, but in this case it is made of malleable iron heavily galvanized. It fits all one-half-inch conduit knockouts. A shoulder is provided for fitting against the edge of the box. Both types of these connectors are unique in being one-piece devices and in eliminating special lockouts and bushings. They are very quickly applied and provide a secure connection to the box. These connectors are made by the Adapti Manufacturing Company, Cleveland, O.

New Motor-Generator Set for Charging Automobile Batteries

The Robbins & Myers Co., Springfield, Ohio, have just recently developed the motor-generator set shown herewith, for charging batteries for automobiles, motor boats, etc.

They may be operated from 110 and 220 volt direct current or 115 and 230 volt, 60 cycle alternating current. Three sizes are made—80, 150 and 250 watts. The 80 watt size is suitable for private garage service, but it is sometimes used in public garages where the service is light and not more than one battery has to be charged at a time. The 150 and 250 watt sizes are for public garage service. The 80 watt, 8 volt outfits will charge one 3 cell, 60 volt battery at a time, starting at a 10 ampere rate. The 150 watt, 15 volt outfits will charge at the same time, either one 12 volt, or one 6 volt, or two 6 volt batteries in series, starting at a 10 ampere rate. The 150 watt, 30 volt outfit and the 250 watt, 30 volt outfit will charge at the same time, either four 6 volt batteries in series, or two 12 volt batteries in series, or one 12 volt and two 6 volt batteries in series, or one 24 volt battery. The 150 watt set starting at a 5 ampere rate and the 250 watt set starting at a 10 ampere rate. To use, a plug on the motor cord is screwed into a lamp socket and the switch turned

on. After the set has attained full speed, the generator terminals are connected. As the generators are shunt wound, either clip can be connected to either terminal of the battery, and the generator will adjust itself automatically to the polarity of the battery. After the battery becomes fully charged the generator may be left floating on the battery without injury. The 80 and 150 watt sets are designed so as to automatically give a tapering charge to the battery, and no rheostat is needed in the generator field. The 250 watt sets are furnished with a rheostat in the generator field for adjusting the rate of charge. The motors of all these outfits will operate without injury on voltages 10 per cent. higher or lower than normal. The motors can be thrown directly across the line; no starting rheostat is required.

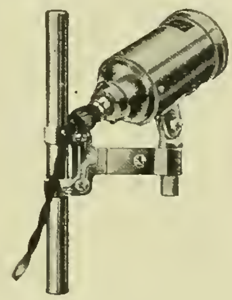
Large Capacity Outdoor Sub-stations for Industrial Service

The increasing use of high capacity outdoor sub-station equipment is well illustrated by the installation shown herewith, which supplies industrial loads from a 33,000 volt, 3 phase, 60 cycle transmission feeder. The transformers are of 500 kv.a. capacity each, stepping from 33,000 to 2,300 volts, the secondary lines being run in the usual manner to various consumers. A spare transformer forms a permanent part of the installation, and can be quickly connected in case of failure.

The high tension control equipment consists of a standard 3-pole air break switch, three choke coils and three 15 ampere chemical fuses. The lightning arrester installation is equipped with three single pole underhung disconnects, by means of which the arresters can be cut out of service. The secondary circuits are controlled by oil switches, mounted in the distribution house, from which the industrial lines are carried. By means of a permanently grounded operating handle the 33,000 volt air break switch can be controlled, the fuses being easily reached from the platform —after the main switch is opened. The air break switch, choke coils, fuses and disconnects are of the standard form, manufactured by the Delta-Star Electric Company, Chicago, the electrolytic arresters being of General Electric manufacture and the transformers of Westinghouse type. That large central stations are now extensively using outdoor equipment for important industrial loads of this class is conclusive evidence that the outdoor sub-station has demonstrated its reliability.

Automobile Dirigible Searchlight

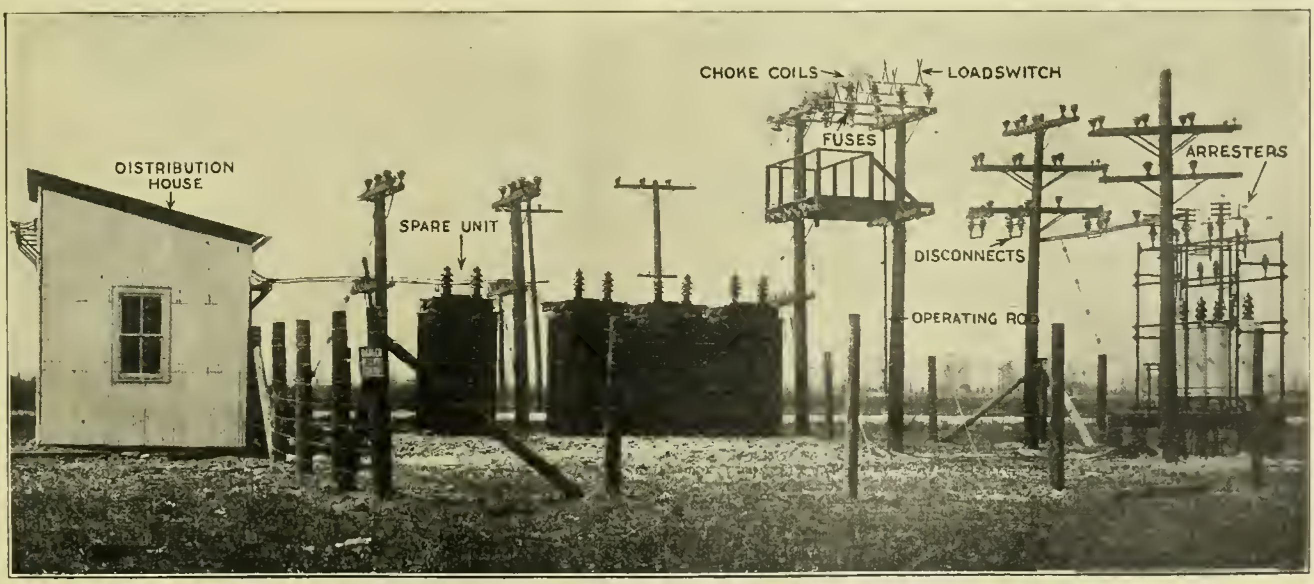
An improved searchlight for automobiles, known as the "Pittsburgh Dirigible" is illustrated herewith. This is a small compact lamp for wind shield mounting, equipped with two high power lenses and a mazda bulb. It operates at 6 volts and gets its supply of current from the lighting system, or can be used with a dry cell battery, if desired. It is cylindrical in shape, 6 inches long by 2¼ inches in diameter and is attached to the wind shield by means of a universal joint, which permits it to be turned in any direction. The beam of light which it throws enables the driver to read signboards and house numbers without moving from his seat. It also affords him a light for backing the car, for illuminating short turns, and for picking out objects that are out of the range of the ordinary headlight.



Dirigible searchlight for automobiles.

It is easily removable from the wind shield and when detached becomes a convenient lamp to use as a trouble finder and in the garage. This new searchlight is being manufactured by the Pittsburgh Electric Specialties Co., Pittsburgh, Pa.

The Cedars Rapids Manufacturing and Power Company have made a contract to supply an additional 10,000 horse power to the Aluminum Company of America, Massena, N. Y., delivery to commence in March next. The latter concern are the chief customers of the Cedar Rapids Company, taking 60,000 horse power. As the new contract will, with present requirements, absorb practically the whole amount of current being generated, it is intended to install units for a further 20,000 horse power, a certain amount of work to this end having already been carried out.



Outdoor sub-station serving industrial loads from transmission line. (1500 k.v.a. capacity—33000 volts, 3 phase, 60 cycle.)

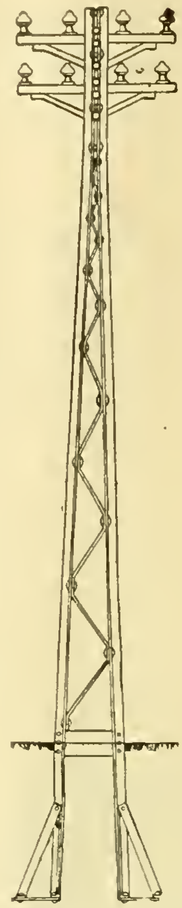
Starter and Speed Regulator

The Industrial Controller Co. of Milwaukee, have recently developed a combination starter and speed regulator of the multiple switch type which has many novel features, and cut of which is shown above. The first three switches of this controller are used for starting duty only, the next four for speed reduction by means of inserting resistance in the armature circuit, and in addition to speed reduction, speed increase above normal speed is obtained by inserting resistance in the shunt field. The controller is arranged with two levers for operating the switches. One of these levers must be held up by the operator with his left hand while

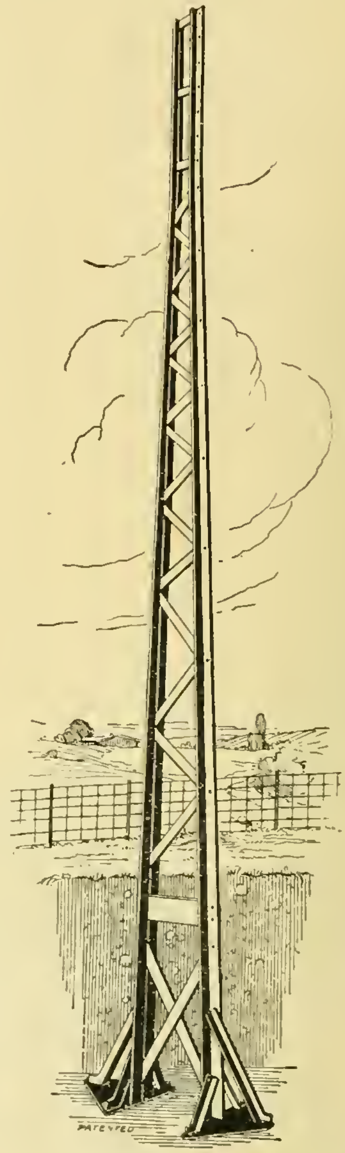
the first three switches are put in place with the right hand lever. Should the left hand lever be released at any time before these three switches are set, they will all return to the off position thereby preventing the use of the first three switches for anything but starting duty. When these switches have been set, the remaining four may be operated in or out at will by means of the right hand lever. The shunt field resistance is inserted when all the multiple switch levers are in place by means of a small lever on the lower panel. No voltage release protection is provided so that should the line voltage at any time fail or be interrupted, all of the field and armature levers will immediately return to the off position, thereby stopping the motor and protecting it against injury on return of the line voltage.

A "Different" Steel Pole

The steel transmission pole illustrated herewith differs from the ordinary steel pole in that it is set without cement or other solid material, which so frequently causes trouble on transmission lines where the poles bend at the surface, the upper portion forming merely a leverage to produce this result. The pole illustrated is simply set in the ground, having its base broadened in such a manner that when set in the hole the earth can be tamped into the flanges. This gives the earth the necessary grip to prevent the possibility of an uplift through contraction of the wires or the rise of the system from a low lying ground to a higher level. The flanges also set against the undisturbed and naturally hard walls of the pole hole which form a cushioning underground brace for the pole which gives slightly when any shock occurs above the ground line, and thus aids the natural resiliency of the steel to prevent breakage. A few inches below the surface a broad sway plate aids in overcoming the shock or strain and as this is also cushioned in earth alone a sufficient rebounding quality is given to the pole to aid it in returning to its former position after the shock or strain. It has been found that in a system of earth-cushioned poles, the force of any shock or strain is distributed along the entire system until it is dissipated instead of against only one or two poles, just as when a stone is cast into a lake, the



Two views of steel pole of Carbo Steel Co.



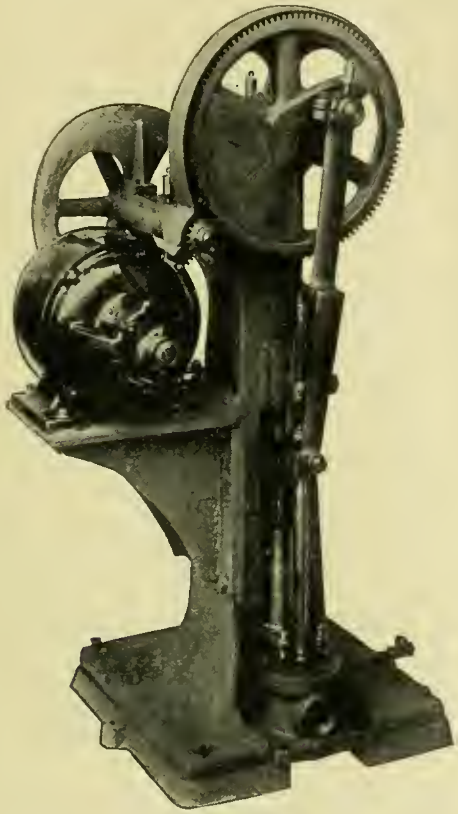
disturbance of the water sends ripples outwards from the centre of contact. In consequence, owing to the springy character throughout of an earth cushioned pole system, the possibility of breakage of any pole from the effects of a storm or other force is lessened vastly, because by the ability of the pole to bend and make its fellow poles lend their united self aligning strength it compels a distribution of the weight of the shock or strain until that weight dies away in ripples, just as the wavelets of a lake die away. This pole is being placed on the market by the Carbo Steel Company, Chicago, Ill.

Mr. Fellows in New Quarters

Mr. W. R. Fellows, Jr., Blenheim, Ont., has purchased the Erie House hotel property, in the most central part of the town, and will open an electrical supply store from which his wiring and supply business will be conducted in the future. Mr. Fellows has been in the wiring and supply business in Blenheim for the past four years.

Deep Well Pumping Head

Every person situated out of reach of the city water mains realizes the need of an abundant supply of good water. Dairy and truck farms, country estates, and in fact, every water consumer who is dependent on some local source of water supply and who is situated in a locality where water does not lie near the surface, will be interested in the new Hill deep-well pumping head shown in the accompanying illustration. When operating 2-inch, 2½-inch or 3-inch single acting cylinders it will raise water to total heights of 180, 125 and 90 feet respectively. It can be used with any of the common forms of well cylinders. This head can be used in



New electric pump.

connection with open or elevated tank systems or with closed tank pneumatic pressure systems. When used with the pneumatic pressure system, an air pump furnishes air to the tank through the water discharge. Water is raised on the upstroke while air is forced in on the downstroke, thus equalizing the pressure.

The motors used on these heads, one of which is shown in the illustration, are ¾ h.p. Westinghouse Electric single-phase type AR. The motor is mounted rigidly on an extension of the pump support and is capable of starting the pump under full load. The whole outfit is very compact, quiet in operation and extremely economical. It can be operated twenty-four hours every day and requires practically no attention.

Efficient Grounding Device

The illustration herewith shows the type "A" grounding device, assembled complete, of the Fargo Manufacturing Company, Poughkeepsie, N. Y. This device has a very positive contact, the wire being carried to damp earth; it can be easily disconnected for test and as easily reassembled. With the use of this company's connections and grounding devices it is claimed that as high as 20 per cent. of the current can be saved.

Tennis by Night Light

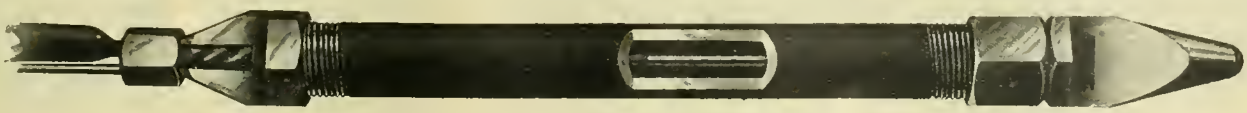
The popularity of tennis has always been more or less affected by the fact that its successful playing demanded the best of daylight. Winter tennis has proved less popular than expected largely by reason of the short, dark days. As an evening game, however, satisfactory alike for players and onlookers, it possesses great possibilities if only the proper conditions of good lighting can be obtained. Little by little with advances in the art of illumination tennis as a night game is coming into its own. During the past year a number of installations have been reported as proving more or less successful and with increasing knowledge of the requirements of the game it looks as if an artificially lighted court with both quantity and distribution to meet the most exacting demands is about to be realized.

The accompanying illustration shows what excellent results can be obtained without any elaboration of wiring or lighting units. The court shown here was opened for the first time on August 4th in a large United States city and,

Night photograph of Tennis Court.

it is said, will be followed by a number of others in the same city. The equipment as described in the Electrical Review is very simple indeed and should not prove at all prohibitive in cost to any tennis club.

Four 1,000-watt type C mazda lamps, hung 30 feet above the court, on 28-foot centres, supply all the light. Each lamp is equipped with a B-33 1,000-watt Holophane reflector. The arrangement of the lamps puts the two interior lights about half way between the service line and the net, while the remaining lamps are suspended over points back of the base lines of the court. Two poles serve to carry the outfit, properly guyed and in such a way that the guy wires are back of the backstop nets. A double-pole, single-throw, fuse switch, 60 amperes, serves to control the current.



Type "A" grounding device, Fargo Manufacturing Company.

A 60 Watt Nitrogen

The Canadian Laco-Phillips Company, Limited, have added a new lamp to their line, a 60 watt nitrogen, giving

a candlepower of 70. The new lamp is illustrated herewith.

Jove and Jupiter for Window Lighting

A new era in store window lighting has been brought about by the invention of the gas-filled mazda "C," commonly known as the nitrogen lamp. As is the case with most new things, the nitrogen lamp is being used by many who have no knowledge of its construction and very little concerning its application.

Many of the merchants who are lighting, or attempting to light their store windows with the mazda "C" lamps use equipment that was designed for a wholly different style of incandescent lamp. It is important that the folly of such attempts shohld be pointed out. Satisfactory results cannot be secured from these or any lamps unless they are used with proper reflectors. Merchants who use type "C" lamps in their old reflectors (designed for the vacuum tungsten lamp) are disappointed because there is not the great increase in illumination they expect. Naturally they condemn the lamp, whereas it is very efficient if the intense light which it produces is properly directed. As these new gas-filled lamps, particularly the 100-watt, will undoubtedly be used to a very considerable extent in window lighting, the following facts concerning their construction and the accompanying suggestions as to their correct use are set forth.

These lamps differ from the lamps formerly used, in that the filament, or light source, is located close to the lower end or tip of the lamp and is much reduced in size. Owing to this concentration of the light source, and its location, it is necessary, in order to protect the eye from its intense glare and to throw the light down into the windows, that the reflector must have a particular shape. Not only must the shape of the reflector be correct, but it is necessary to have spiral corrugations. Furthermore, these corrugations must be rather small. The filament of the lamp, being so concentrated, straight corrugations result in what is called striations, or streaks of light and shadow. The small corrugations break up the intense light rays, and, if the reflector is of correct shape, the light is thrown straight down into the window and sufficiently high into the background to cover the window trim evenly. The correctly shaped reflector secures wonderful results, preventing the light rays from going to the top or side of the window, or out on the background.

This new lamp of 100-watt size, which seems to be the most practical for window lighting, produces 125 c. p. as against 105 of the 100-watt mazda lamp so generally used. As nitrogen lamps generate extraordinary heat, it is necessary that the reflectors have a special backing which will withstand high temperature indefinitely. We are illustrating here two new, powerful X-ray window searchlights which have been produced for use with these lamps. Their shape, corrugation and high temperature backing conform to the requirements which have just been described. Reflectors of two distinct shapes are necessary. One called the "Jove," is suitable for windows of average proportions —that is to say, windows which are from one to one-and-one-half times as high as they are deep, the depth being measured from the front glass to the background. The "Jupiter," a reflector with increased concentrating power, is designed for windows the height of which is approximately twice as great as the depth. These reflectors will give a higher intensity of uniform illumination than has ever before been delivered with 100 watts of electric current.

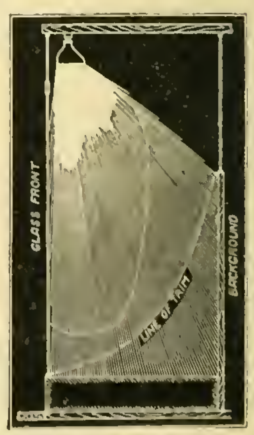
Too much emphasis cannot be placed upon the fact, that for correct window illumination the light filament of the lamp should be contained in reflectors that prevent the passerby or person in the store seeing the light source. This is now a well-recognized principle in illumination, but from observation it would seem that many merchants do not realize its importance.

The illustrations show these too new window reflectors and the "curve" or direction in which the main flux of light is thrown into a window by the combined use of the reflector and the hundred watt gas-filled lamp.

Jove

Jupiter

Light distribution in window from 100-watt "C" lamp in "Jove" reflector.



Light distribution in window from 100-watt "C" lamp in "Jupiter" reflector.

Current News and Notes

Brandon, Man.

The street railway extension along Percy Street was placed in operation on Saturday, August 14th. Superintendent Boden stated that this would allow of the cars being run as a belt-line in the future. Further construction will be carried on along College Avenue and 18th Street, equipment for which is already on the ground.

Chatham, Ont.

J. G. Jackson, manager of the Chatham Hydro-Electric System, has recommended that the city purchase new equipment for their water pumping plant which will be operated electrically.

Calgary, Alta.

The street railway receipts are showing increased profit month by month and promise well to wipe out the deficit of the earlier months of the year. In July the net profit after all expenses were paid amounted to $2,500.

Carleton Place, Ont.

Tenders were received by C. F. R. Taylor up to August 25th for the construction of forty miles of rural telephone lines.

Goodwood, Ont.

The Goodwood Rural Telephone Company has been incorporated.

Kelowna, B. C.

Messrs. DuCane, Dutcher & Co., engineers, Vancouver, are in consultation with the city council of Kelowna, in the Okanagan Valley, with reference to installing a hydro-electric system at a cost of about $120,000. The proposition will likely be submitted to the ratepayers in the near future.

Liverpool, N. S.

A by-law was recently passed authorizing the expenditure of $10,000 on extensions to the electric system.

London, Ont.

The Public Utilities Commission propose considerable extensions to their street lighting system, consisting in the erection, at two hundred principal street intersections, of 400 c.p. nitrogen filled lamps on long brackets; also increasing the candlepower of the lamps on the present series system from 75 c.p. to 150 c.p. These changes will necessitate the installation of three new constant-current regulators with panelboard and additional circuits on the streets. It is also the intention of the Commission to install an ornamental system on the residential streets and supply the lighting without extra charge where the property owners are willing to bear the cost of the installation.

Listowel, Ont.

A by-law was recently carried authorizing the expenditure of $6,600 on an electrical distribution system.

Montreal, Que.

Next month the Bell Telephone Company will cut in new offices at St. Catharines and Brockville, Ont.

The following Montreal electrical firms have notified their employees who intend to enlist that their positions will be waiting for them on their return:—Montreal Light, Heat and Power Company, Northern Electric Company, Bell Telephone Company, Eugene F. Phillips Electrical Works, and Shawinigan Water and Power Company.

Newmarket, Ont.

Town clerk Anderson is reported as stating that the electric bills under the new contract with the Toronto and York Radial Railway Company will be just about half what they have been in the past when the plant was municipally owned and operated.

New Glasgow, N.S.

The Pictou County Electric Company are installing "safety-first" signs on all their passenger coaches instructing their patrons, among other things, to use particular care in getting on and off the cars.

New Westminster, B. C.

C. Rummel, Vancouver manager of the light and power department of the British Columbia Electric Railway for a number of years, has been transferred to New Westminster. He took up his new duties in July.

North Vancouver, B. C.

North Vancouver Ferry Company recently installed a 10 kw. generator and equipment for the lighting of the ferry wharf and offices at North Vancouver. The contract went to the Wheeler Electric Co.

Orangeville, Ont.

A by-law will be submitted on September 4th authorizing the purchase of the private plants at present distributing light and power in Orangeville, and for necessary extensions in connection with the introduction of Niagara power.

Quebec, Que.

The Civic Road Committee has recommended to the city council that the contract for lighting the streets of the city be transferred from the Dorchester Electric Company to the Public Service Corporation of Quebec, which has absorbed the former. It is stated that the Public Service Corporation will have their transmission line completed from Shawinigan to Quebec City by February 1916.

Toronto, Ont.

Commissioner Harris recommends that the city take over and operate such parts of the Mimico and Scarboro Radial lines as are within the city limits. The Commissioner also states that he is ready to submit plans for the bridge over the old belt-line in connection with a road through Mount Pleasant Cemetery.

Thistletown, Ont.

A movement is on foot to supply the citizens of Thistletown with electric light and power from the Weston substation.

Vernon, B. C.

The city of Vernon will install an auxiliary pumping station at B. X. Creek, to consist of a pump of large capacity to be driven by a 50 h.p. electric motor owned by the corporation. Power will be supplied by means of a pole line to be constructed along the pipe line right of way.

Victoria, B. C.

Electrician Hutchison, of Victoria, has favored the purchase of 3,000 new type nitrogen-filled lamps of 40 candle power for use on the city cluster lighting system.

Vancouver, B. C.

C. F. McCullough, formerly chief clerk in the office of the general superintendent of the B. C. Telephone Company at Vancouver, has been promoted to the position of contract agent, left vacant owing to the departure of Mr. J. A. Whan to Honolulu to take up another line of business.

Winnipeg, Man.

The annual report of the Manitoba Government Telephone System for the year ending November 30th, 1914, showed a surplus of $56,000.

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Electric Flatiron Now Leads In Home Devices

A compilation of appliances sold by United States manufacturers since the "electrical servant" came into use shows that more than 8,000,000 electrical devices are now being used. It is, of course, impossible to get the full records of appliances sold, but a list just prepared by the Society for Electrical Development places the flatiron far in the lead. The tabulation follows:

Irons	3,025,995
Fans	1,629,414
Vacuum cleaners	469,282
Toasters	411,645
Disk stoves	234,883
Washing machines	212,082
Grills	114,267
Percolators	106,278
Heaters	76,925
Heating pads	67,107
Chafing dishes	29,316
Ironing machines	28,000
Ranges	14,140
Teapots	6,397
Radiators	3,190
Dish washers	261
	6,429,182

Additional figures cover devices not itemized above and add probably more than 2,000,000 to the total, which makes more than 8,000,000 appliances in daily use.

Cooking and Heating Appliances On the Increase

Report, covering three months ending April 30th, 1915, also for twelve months ending same date, was recently submitted by Mr. F. A. Cambridge, city electrician. These naturally reflect the great falling off in this class of work. It is gratifying to learn, however, that in spite of the depression in all lines of work, the use of electric cooking and heating appliances is steadily increasing. The following figures will show the growth in the past four years:—

Fiscal Year	Cooking and Heating Appliances Installed
1911-1912	144
1912-1913	619
1913-1914	1,323
1914-1915	1,628

According to Mr. Cambridge's report the above is only a fraction of the total as the inspection hardly ever touches the smaller appliances such as domestic irons, toasters, etc., these being bought and connected to lamp socket by purchaser. This growth has brought about a problem in the overloading of branch lighting circuits in buildings. The department is now considering the matter and will in the near future submit a suggestion which it is believed will meet this difficulty and meet the public need.

Development on Elbow River Under 475 Foot Head

As a culmination of several years' thorough investigation by engineers of the Dominion Water Power Branch and private interests desiring the right to develop water power on the Elbow river near the city of Calgary in the Province of Alberta, the Dominion Government has recently issued an agreement under the Dominion Water Power Regulations covering a project, the general plans of which have been worked out by Messrs. Ducane, Dutcher & Co., Consulting Engineers of Vancouver, in consultation with Messrs. C. H. and P. H. Mitchell of Toronto, Consulting Engineers to the Dominion Water Power Branch. This scheme of development contemplates the development of a 475 ft. working head. A dam 123 feet maximum height, and 565 feet long on the crest spans the river forming a storage reservoir of 21,000 ac. ft. capacity. From the reservoir a pressure tunnel carries the water direct to the power station and turbine some 4¼ miles below, driving generators of a maximum capacity of 15,000 h.p.

An agreement covering this project has been issued in accordance with the strict conditions of the Water Power Regulations which provide for the immediate commencement of construction operations in accordance with plans which have just been accepted and approved by the Dominion Water Power Branch. The agreement provides that at least 2,000 horse power must be developed and made available for use by July 15, 1919; that the continuous beneficial operation of the plant and the carrying on of the whole business arrangement must be acceptable to the Dominion Government; that control of rates to consumers of power and the rental to be charged for the privileges granted shall be under the control of the Government and subject to periodic revision. The taking over of the plant by the Government is also provided for, should the public interest demand such a course in the future.

Steel Reinforced Aluminium Cables

By E. T. Driver and E. V. Pannell

With the rapid developments taking place during the last few years in long distance power transmission, many new forms of conductor have been introduced. At the present day there are in use, besides ordinary solid wires, stranded conductors of both copper and aluminium, some laid up around a hemp and others around a soft wire core. Several forms of combined copper-steel wire are being employed, and in some instances on extremely long spans, cables of plow-steel have been strung. In Germany at the present time, owing to the copper and aluminium shortage, considerable efforts are being made to produce galvanized iron wire having the lowest possible resistance and permeability to permit of its use for alternating current transmission. Perhaps the steel-centre aluminium cable, however, affords the best combination of conductance and mechanical tenacity.

The Sierras & San Francisco Power Company was one of the first to place steel-aluminium cables in extended use, employing this material on the 70-mile line running from Port Marion to Salinas, California.

Table I.

Users of Steel-Reinforced Aluminium Cables

	Size C. M.	No. of Wires in Cable: Aluminium	Steel
Pacific Light & Power Co.	605,000	54	7
Southern Sierras Power Co.	211,160	6	1
Hydro-electric Power Commission ..	various	..	..
Cedars Rapids Mfg. & Power Co. ..	500,000	30	7
Tennessee Power Co.	250,000	6	7
Tennessee Power Co.	400,000	30	7
Central Georgia Power Co.	176,000	6	1
Sierras & San Francisco Power Co. ..	137,000	6	1
Mount Whitney Light & Power Co.	26,250	6	1

During the last few years, however, a very large quantity of steel-core aluminium has been strung on the systems shown in Table 1, so that this class of cable has developed far out of the experimental stage. The simplest form of the cable consists of six aluminium wires stranded around a single steel wire of the same size. A better arrangement, where possible, consists in using a seven-strand steel core as being more elastic than a single wire. Either arrangement gives a ratio of area aluminium: steel of 6. Cables larger in area than 250,000 c.m. consist generally of 37 wires, of which the centre 7 are steel, giving a ratio of 5.3, and where larger than 350,000 c.m. of wires, of which the seven wire core is again of steel, giving a ratio of 8.7. These different propositions will be seen to have important influence upon the characteristics of the cable. Aluminium and steel wire as employed for transmission line work have the following properties:

Table II.

	Aluminium	Steel.
Tensile strength lbs. per sq. in. ...	24,000	160,000
Elastic limit lbs. per sq. in.	14,000	130,000
Modulus of elasticity lbs. per sq. in...	9×10^6	30×10^6
Expansion Coefficient deg. F.	$12.8 \times 1/10^6$	$6.4 \times 1/10^6$

These figures apply to the product of the British Aluminium Company. Of course, higher or lower strength on either of the metals can be obtained; the above, however, are representative values. Considering a composite cable made up of two materials with such widely different properties it might at first be thought that they would expand and contract at different rates, thus leading to very unequal stresses. As a matter of fact, when the cables are securely dead-ended they take up quite definite characteristics almost midway between those of aluminium and steel. By analysis the following figures have been arrived at and practice has shown them to be correct within the ordinary limits of error.

To all intents and purposes therefore the composite cable behaves just like a wire of some simple material having the above properties. There is, however, an internal exchange of tension which does not appear in the above table. When the temperature falls the aluminium envelope will tend to shorten up more than the steel. If the cable is properly dead-ended, it cannot actually so shorten, the result is therefore a higher value of tension in the aluminium. Conversely at high summer temperatures the greater tendency of the aluminium to elongate reduces the proportion of stress in this material. Considering external loads such as wind or ice the incidence of these will cause extension of the cable as a whole and so the extra load will be almost wholly carried by the steel.

Mention has been made of the importance of a secure dead-end. It is, of course, absolutely necessary that a positive grip be obtained on both metals, otherwise the core will tend to pull out and throw all the tension on the aluminium envelope. The illustration (Fig. 1) shows the Canadian Porcelain Company's type of clamp in which, as will be seen, the steel centre is brought out and snubbed off independently of the aluminium. Both materials are firmly held in the eight-bolt grooved clamp, but the steel is given two turns around the snub and clamped separately so as to develop its full strength. The remaining aluminium wires are twisted to form a jumper and laid in the grooved extension piece being held by a hook bolt whilst the clevis makes connection with the insulator chain. The main feature of clamps of this type, apart from the steel snubbing device, is that the cable is held in direct line with the span, no bend taking place where under tension. Any risk of abrasion is precluded by having the eight-bolt clamp lined with a cast aluminium inset. This clamp will sustain a maximum pull of 12,000 lbs., whilst the snub will hold the steel up to its breaking limit.

The chief advantage of steel reinforced aluminium cables lies, of course, in the possibility of their being strung more tightly than copper or aluminium, so that a line can be erected with smaller sags and consequently more cheaply. A typical two-circuit galvanized steel tower costs about $2 per foot of height, exclusive of erection. If it is possible to decrease the sag by 10 feet the tower can be shortened by just that amount, and with nine or ten towers to the mile the saving in cost becomes something quite appreciable. As against this, however, it must be mentioned that the dead-end and corner towers have to be heavier, that the cable is about 15 per cent. more costly, and that it cannot be handled

Table III.

Size of Cable (Aluminium only.) Up to	No. of Wires: Aluminium	Steel	Modulus of Elasticity	Tensile Strength	Elastic Limit	Coefficient of Expansion
250,000	6	1	12×10^6	27,000	30,600	$10.51 \times 1/10^6$
350,000	30	7	13×10^6	53,100	35,900	$10.0 \times 1/10^6$
700,000	54	7	11.4×10^6	43,100	27,500	$10.87 \times 1/10^6$

in the field quite so easily as straight aluminium. Nevertheless, the decreased deflection is a very powerful advantage, particularly where spans of 800 feet and upwards are to be negotiated.

Using the figures given in Table 3 and by means of a Thomas chart the sag curves of Fig. 2 have been worked out. These, as will be seen, cover not only steel-core aluminium, but also straight aluminium and copper. The area

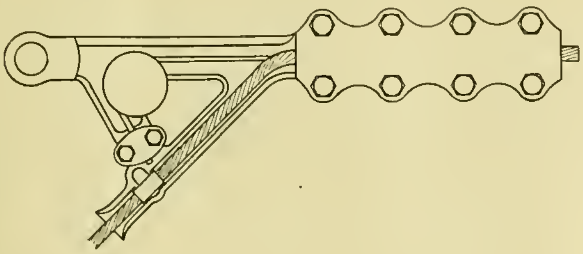


Fig. 1

of the cables is that of the equivalent copper in each case so they are reduced to a common basis for comparison. The sags shown are maximum summer ones based upon the following assumptions:

Minimum temperature, deg. F.	0
Wind velocity, m.p.h.	70
Wind pressure, lbs.	12
Ice thickness	½ in.
Maximum stress, aluminium	14,000 lbs. sq. in.
Maximum stress, steel	80,000 lbs. sq. in.
Maximum stress, copper	30,000 lbs. sq. in.

From this standpoint it will be seen that steel centre

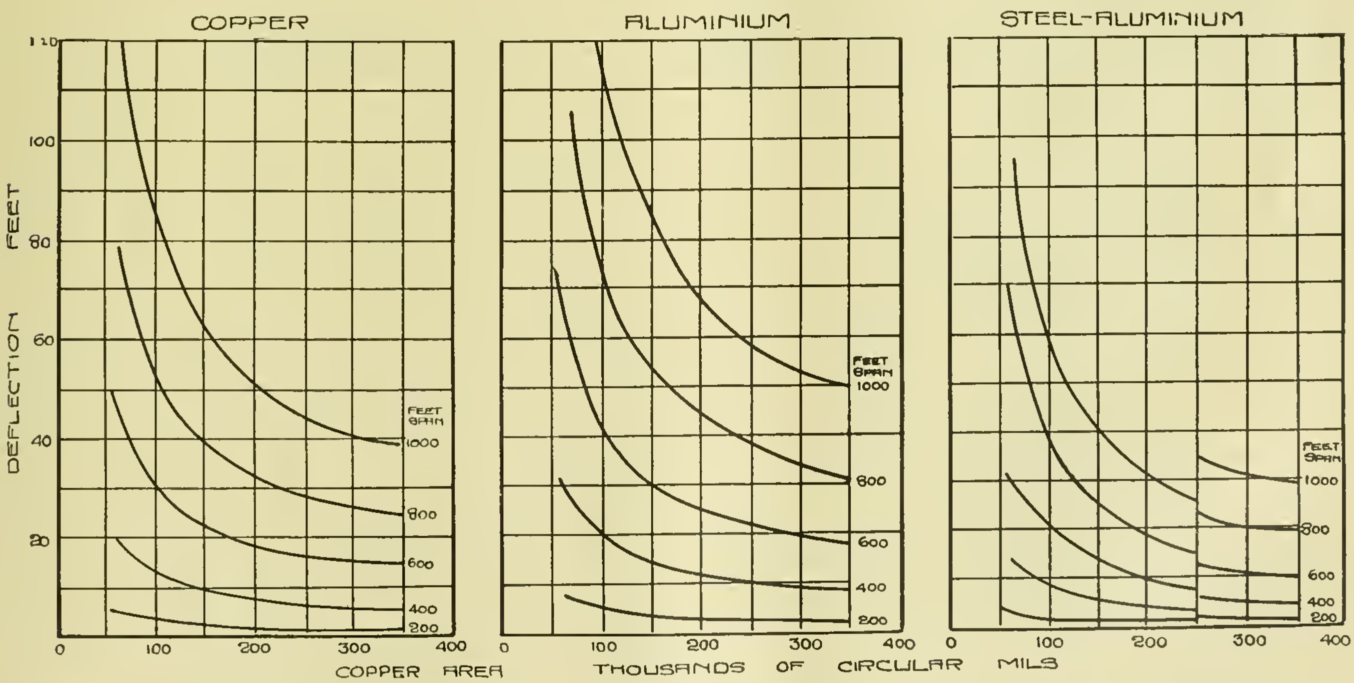


Fig. 2

aluminium is far superior to simple copper or aluminium. The characteristics of the composite material when erected will show less whipping and swinging, consequently spacings can be lessened and crossarms shortened up. No doubt the widest field for steel core aluminium will be for cables smaller than 250,000 c.m., as it is in these small sizes that the most marked reduction in sag is effected by the use of the reinforced cable.

Electric Pumps Used for Removing Water from the Manhole on the Chilliwack Sewage System at Chilliwack

Supplement to article appearing in Electrical News, March 15th, 1915. By D. Penzer Dunn, Assoc. A.I.E.E.

Owing to the sudden flooding of a manhole on the Chilliwack sewage system caused by the bottom having been forced out by underground water pressure (natural freshets) the pumps having been removed before the concrete had set properly, it was necessary to drain out the excavation before the work of re-construction could be recommenced; to do this it was necessary to use two centrifugal pumps of 11 and 20 h.p. respectively; the original pump of 11 h.p., which had been used heretofore during construction was inadequate in this case, so the 20 h.p. pump had to be added to cope with the large amount of water present.

The capacity of pump No. 1 was 400 gallons per minute, while that of pump No. 2, 700 gallons per minute, making a combined capacity of 1,100 gallons per minute; this had to be maintained continuously in order to enable the work of re-setting the machine base to be completed.

Pump No. 1 had a speed of 850 r.p.m., 6-inch suction with 4-inch discharge, capable of maintaining a head of 10.5 feet, and was belt driven to an 11 h.p., 220 volt, 3-phase, 6 pole induction motor of 1,130 h.p. Pump No. 2 had a speed of 600 r.p.m., 6-inch suction with 5-inch discharge, capable of maintaining a head of 17 feet, being belt driven to a 20-h.p., 220 volt, 3-phase, 6-pole induction motor of 1,200 r.p.m. These These pumps were located about 600 feet from the power company's transformers, which step the voltage down from 2,300 to 220 volts. The transformers were connected in delta on high and low tension sides, the capacity of each being 15 kilowatt and are the same used to operate the sewage pumping system where they are located.

The line from the transformers to the motors was of temporary construction, being supported on reel porcelain insulators on the side of the poles; this line was of No. 3 weatherproof copper, which insured against undue voltage drop between the motors and the source of supply at full load.

The "Science" of Electric Cooking (Con.)

Results of Experiments in Baking—Definite Relation Between Temperature and Loss in Weight—Greatest Economy when Oven is no Smaller than Required —Can be Reduced to an Exact Science

Owing to a lack of definite information on the time and temperature of baking, a series of experiments were undertaken on the baking of biscuit, bread and sponge cake. The purpose of the experiments was to determine the range of temperatures within which each article of food could be satisfactorily baked and the particular temperature within this interval which was the most economical for the ovens tested.

The method used was to determine the minimum time of baking at several oven temperatures. The experiments at a particular temperature were started at what was thought to be the proper time of baking at that temperature. If the condition of the food was well done and well browned, the time of baking was reduced. This process was repeated until under done samples were obtained. The shortest time of baking which gave satisfactory results was the value taken for that particular temperature. This was repeated for several oven temperatures and curves were plotted between the temperature of the oven and the minimum time of baking. Each sample was carefully weighed before and after baking and the per cent. loss of weight determined. The per cent. loss of weight obtained at the minimum time of baking was then plotted against the oven temperature. Each point obtained on this curve was the means of three determinations. The experiments were first performed in oven No. 1 and then were checked in the other ovens.

Because of the short time of cooking and the small amount of food used in each sample it was not found possible, as in the meat experiments, to get accurate measurements of the amount of heat absorbed by the food. Consequently the amount of energy used in baking at the various temperatures in each oven was taken at the sum of the losses.

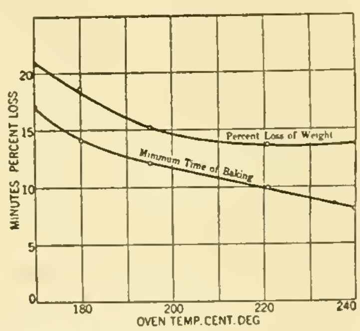


Fig. 10.—Effect of oven temperature on time of baking biscuits and per cent. loss of weight.

The materials for the baking experiments were furnished by the home economics department of the University of Missouri. The samples were prepared by the members of that department as they were required and were inspected by them after baking.

Fig. 10 shows the minimum time of baking and the per cent. loss in weight curves for biscuits. Each sample consisted of six biscuits, each weighing approximately 25 gm.[1]

1. They were prepared according to the following recipe: 1 cup of flour, 1 tablespoonful of lard, ½ teaspoonful of salt, 2 teaspoonfuls of baking powder, enough milk to make a soft dough.

It will be noticed from the curves that the per cent. loss of weight begins to increase very rapidly as the temperature decreases below 200 deg. This increase in the loss of weight for the biscuits at the low temperature indicated that the samples dried out to a greater extent due to the increased time of baking. This was very evident in the character of the biscuits prepared at these temperatures. They were dry and hard and had a heavy crust instead of being crisp and tender. At 200 deg. and above there was no difference discernible in the character of the samples. The range of temperature, therefore, for baking biscuits prepared according to the above recipe is from 200 to 240 deg. cent. Table VIII., which gives in detail the results of the biscuit experiments, will make clear the method used.

Fig. 11 shows the minimum time of baking and the per cent. loss of weight curves for the bread experiments. The loaves averaged 300 gm. in weight and were baked in a tin the dimensions of which were 3 in. by 5 in. by 3 in. deep.

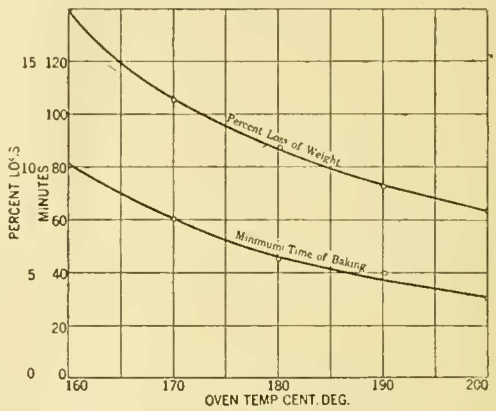


Fig. 11.—Effect of oven temperature on time of baking bread and per cent. loss of weight.

2. The bread was prepared according to the following recipe: ½ cup of water, ½ cup of milk, 1 teaspoonful of lard, ¼ teaspoonful of salt, 1 tablespoonful of sugar, enough hard wheat flour to make a soft dough, yeast.

In the bread experiments the most satisfactory results were obtained above 180 deg. At the lower temperature the crust was hard and thick, due to excessive evaporation of moisture as indicated by the loss in the weight curve. At 240 deg. the outside of the loaf had a tendency to brown over before the inside was thoroughly done. So many factors other than the time and temperature of baking affect the texture and quality of the bread that no attempt was made to accurately score the loaves baked. The quality of the flour, the proportion of the ingredients, and the manipulation before baking all affect the flavor, quality, and texture of the loaf. It may be stated, however, that the range of temperature for baking bread in the above size loaves lies between 180 and 240 deg. cent. As the size of pan used was smaller than is used in the average household, the time required for baking a larger loaf would be somewhat longer.

Table VIII.

Biscuit Experiments

Time of baking min.	Oven. Temp. cent. deg.	Per cent loss of weight	Condition of sample.
10	239.5	15.8	well done, well brown.
10	239.5	15.5	well done, well brown.
10	240.0	15.9	well done, well brown.
8	239.5	12.9	well done, well brown.

8	239.0	14.9	well done, well brown.
8	240.0	13.0	well done, well brown.
7	241.0	10.1	slightly brown, doughy.
7	240.5	10.8	slightly brown, done.
7	240.0	10.1	slightly brown, almost done.
10	220 0	13.0	well done, well brown.
10	221.0	12.9	well done, well brown.
10	221.0	14.4	well done, well brown.
10	220.0	14.3	well done, well brown.
9	220.0	12.9	not brown, doughy.
9	221.0	12.2	slightly brown, done.
12	195.0	14.2	well done, well brown.
12	194.0	15.1	well done, well brown.
12	196.0	15.9	well done, well brown.
10	195.0	8.0	slightly brown, done.
10	195.0	7.2	slightly brown, almost done.
11	195.0	15.0	well done, slightly brown.
11	195.0	13.6	almost done, brown.
11	195.5	14.6	almost done, slightly brown.
14	180.0	17.8	well done, well brown.
14	180.5	19.2	well done, well brown.
14	180.0	18.8	well done, well brown.
13	180.0	13.0	slightly brown, almost done.
13	180.0	11.6	well done, well brown.
13	180.5	14.3	brown, almost done.
15	170.0	17.0	almost done, not brown.
15	170.0	16.5	almost done, not brown.
15	170.0	16.2	almost done, slightly brown.
16	170.5	10.7	done slightly brown.
16	170.5	13.3	done, slightly brown.
16	169.5	12.7	almost done, slightly brown.
17	170.0	20.9	well done, brown.
17	170.0	20.2	well done, brown.
17	170.0	21.2	well done, brown.

Fig. 12 shows the minimum time of baking and the per cent. loss of weight cruves for the sponge cake tests.[3] The loaves averaged 250 gm. in weight and were baked in a tin of the following dimensions: 5.5 in. by 4.2 in. by 2.5 in. deep.

3. The cake was prepared according to the following recipe: 4 eggs, 1 cup of sugar, 1 cup of flour, 1 tablespoonful of lemon juice.

A temperature of 170 deg. is approximately the lowest temperature that should be used for baking sponge cake, as the crust becomes very heavy and thick at the lower temperatures due to the long baking and the large loss of moisture. Because of the larger proportion of liquid in the dough, sponge cake will stand a greater loss of moisture than bread or biscuits. At 200 deg. the loss of moisture was evidently too small as the texture of the crumb was not as good as samples baked at lower temperatures. The range of temperature, therefore, for baking sponge cake lies between 170 and 200 deg. cent.

The curves of Fig. 13 give the energy used in baking biscuits at the various oven temperatures for ovens No. 1, 2 and 4 with and without preheating. The curves show that if biscuits are baked immediately after other food is removed from the oven so that preheating is not necessary the energy required will be very small compared to the amount required if the oven has to be heated up from room temperature to baking temperature. This is especially true of oven No. 1. When the baking is begun with the oven already at the desired temperature, the energy used in baking biscuits is practically the same for all the temperatures tried; but when the oven has to be heated up from room temperature the energy used is considerably less at the lower temperatures. Since the quality of the biscuits baked at temperatures below 200 deg. is not as satisfactory as at higher tempefatures, these

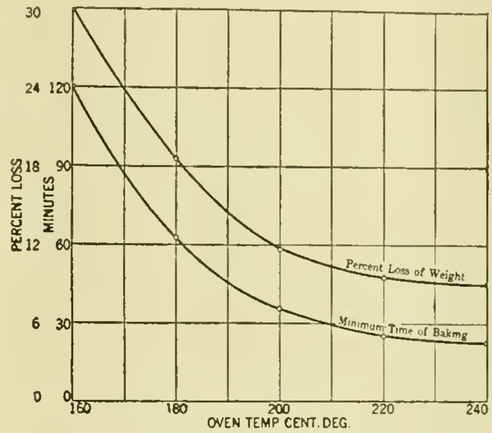


Fig. 12.—Effect of oven temperature on time of baking sponge cake and per cent. loss of weight.

temperatures are not recommended; 200 deg. is, therefore, the most economical temperature for baking biscuits when preheating is necessary.

Because the conditions of baking biscuits satisfactorily are a high temperature for a short time, the greater part of the energy required will be used in preheating. Consequently ovens used for baking biscuits should require as little energy as possible for preheating. This can be accomplished to a certain extent by using as small an oven as is practical.

Biscuit samples were also baked in ovens No. 2, 3 and 4. In oven No. 2 the biscuits did not brown satisfactorily on

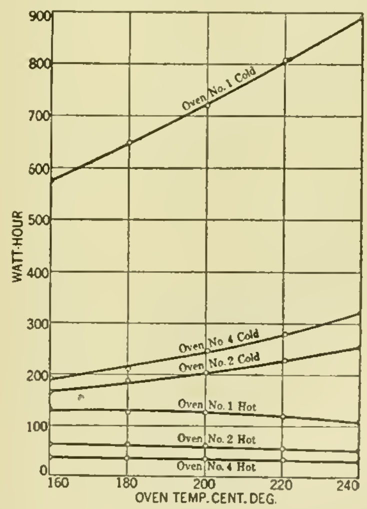


Fig. 13.—Energy required to bake biscuits starting with oven cold and oven hot.

top as there was no heating element in the top of the oven. Oven No. 3 was found to be unsatisfactory for baking biscuits because with the heating arrangement used it was difficult to get high enough temperatures. The biscuits baked in oven No. 4 were satisfactory. The time of baking and the per cent. loss of weight checked with the values obtained for oven No. 1.

The curves of Fig. 14 give the energy used in baking bread at the various oven temperatures with and without pre-

heating. It will be noticed that for all the ovens the energy required is a minimum above 220 deg. The most economical temperature for baking bread when the oven is already heated is therefore from 220 to 240 deg. cent.

The temperature for which the energy required is a minimum lies between 200 and 215 deg. cent. depending on the oven used. Although the insulation of oven No. 4 is very much better than oven No. 2, it will be noticed that above 205 deg. oven No. 4 requires more energy for baking bread than oven No. 2. This is due to the larger amount of energy required for the preheating.

The curves of Fig. 15 give the energy used in baking sponge cake at the various temperatures with and without preheating. As shown by the curves the most economical temperature for baking sponge cake, when the oven is already heated, is 200 deg. cent. Except for oven No. 4 this is also the most economical temperature when the oven is started at room temperature. For oven No. 4 the most economical temperature is 180 deg. but the difference in the energy required at 180 and 200 deg. is slight. Because of the poorer quality obtained at 200 deg., the best temperature for baking sponge cake will be between 180 and 190 deg. cent.

Consideration of the baking curves as a whole will emphasize the importance of the preheating characteristics in designing an efficient electric oven. For the kind of baking which requires a high temperature for a short time the preheating loss is considerably greater than the radiation and convection loss. Unless some method can be found for decreasing the energy used in heating the oven up from room temperature, it will not be practical to greatly increase the heat insulation of the ovens used for domestic baking. This does not apply, however, to ovens which are used for long intervals at the same temperature.

Conclusions

Much has been accomplished recently by domestic scientists in substituting accurate scientific methods of cooking for the vague and indefinite rules of our grandparents. Especially is this true in the field of candy making. There is, however, an enormous amount of work yet to be done before an inexperienced person can hope to get uniformly good results without first experiencing many failures and wasting much good material.

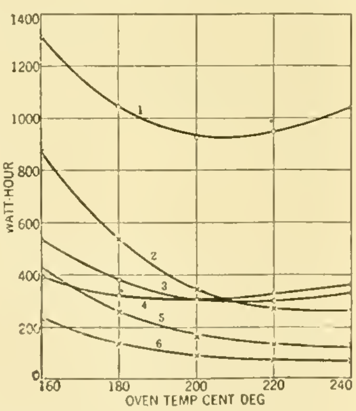


Fig. 14.—Energy required to bake bread starting with oven hot and with oven cold.

1. Oven No. 1 cold 3. Oven No. 2 cold 5. Oven No. 2 hot
2. " " 1 hot 4. " " 4 cold 6. " " 4 hot

With reference to the use of a thermometer for the standardization of oven temperatures Miss M. B. Van Arsdale, assistant professor of household arts at Columbia University, says:

"Regarding the inexperienced housewife, it can truly be said that with an accurate thermometer her results would undoubtedly be more uniformly good—and we believe that the recipe books of the future should not read merely "bake until done in a moderate oven' or 'according to judgment,' but will also state how long and at what temperature, so that in the hands of even the inexperienced these recipes will yield not occasionally good but uniformly good results without the discouragement of many failures, the sacrifice of much time and the waste of much good material. Thus the scientific treatment of the subject added to our traditional knowledge should tend to evolve an even higher type of cookery than we have had in the past."

The present status of the science of cookery is due, in a large degree, to the lack of adequate means of controlling the temperature of the food. When using the ordinary wood or coal cooking range the degree of heat is controlled chiefly by dealing with the food itself rather than by regulating the heat at the point of combustion. The amount of draft necessary to promote the combustion of the fuel causes too great a degree of heat in the oven or on the stove to enable the cook to deal with the food in the proper way except by constantly watching it, stirring it, and changing the position of the vessel on the stove or in the oven.

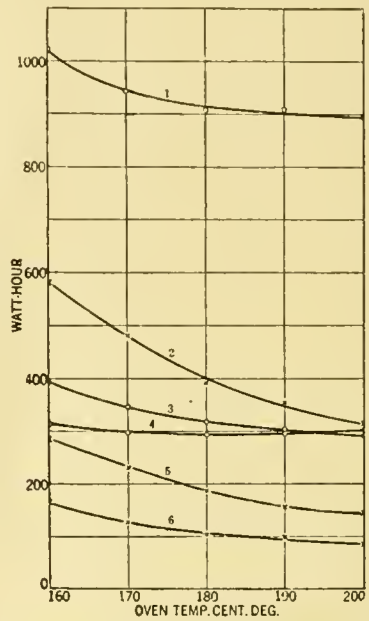


Fig. 15.—Energy required to bake sponge cake starting with oven hot and with oven cold.

1. Oven No. 1 cold 3. Oven No. 2 cold 5. Oven No. 2 hot
2. " " 1 hot 4. " " 4 cold 6. " " 4 hot

With the advent of electric ovens a revolution in the methods of cooking has become possible. Automatic electric ovens will probably be developed in which the temperatures will be accurately controlled and the necessity of constant vigilance will be removed. Some kinds of food will even be prepared in advance, placed in the oven, and without any further attention on the part of the housewife the current will automatically be turned on at a predetermined time. The temperature of the oven will increase to the desired value and there remain constant until the food is properly cooked.

With this method perfected the advantages of electric cooking over the other methods will be great and in many cases the cost will not be excessive. To the possibility of obtaining uniformly well cooked food should be added the saving to the housewife in time and worry, and the absence from the kitchen of excessive heat.

The present-day problem in electric cooking is to determine the methods of cooking that will yield the most in nutrition and flavor, and to formulate definite rules or directions so that a particular article of food can be cooked in the best possible manner by persons of ordinary skill. The

engineer's problem is then to design practical cooking devices in which the temperature can be accurately regulated with a minimum of attention on the part of the housewife.

Electric cooking may be classified according to the temperature to be used in the oven. The baking of bread, cake, and pastry requires a high oven temperature from 170 to 240 deg. cent. In the average family where the oven is used intermittently a large part of the electricity used in this class of baking will go to heat up the oven from room temperature to the required baking temperature. In other words, the preheating loss will be large compared with the radiation and convection loss.

The preparation of vegetables, cereals, and meats (except for searing, broiling, and frying) requires a low degree of heat, 80 to 120 deg. cent., applied for several hours. In this class of cooking the preheating loss is small in proportion to the radiation and convection loss.

The increased popularity of the fireless cooker indicates that people are learning that food can be cooked at temperatures lower than the boiling point of water. The particular temperature of 100 deg. cent. has long been the one used for cooking cereals, vegetables and meats, because it is the easiest temperature to maintain at a constant value and not necessarily because it gives the best possible results. The fact that several hours are required for the cooking is not a disadvantage when the process is automatic and does not require the attention of the housewife. Aside from the question of the quality of the food and the saving in electricity, four hours would probably be the best time to cook the food. The housewife could put in the food for the midday meal immediately after breakfast while the oven was still hot. When it is taken out she could put in the evening meal so that the oven would be used continuously. The preheating loss would thus be reduced to a minimum. During the latter part of the afternoon the housewife need not be tied to her kitchen, as all that would be necessary at this time would be to dish up the food and serve it.

The electric light and power companies should be interested in perfecting this method of cooking and in bringing it to the attention of their customers. A combination of the electric oven and the popular fireless cooker would be a very desirable load for the central station. It would be a nearly steady all-day load and would not interfere with the peak load even in the winter as sufficient heat can be stored in a well insulated oven to keep the food hot enough to serve for an hour or more after the current is turned off.

Since the experiments of the author are very meagre in comparison with the enormous amount of investigation which will be necessary before the art of cookery will be reduced to a science, it is thought that the results obtained will serve more as a preliminary to further investigation than as a basis for immediate reforms in the methods of electric cooking. Even though the complete data were at hand for inaugurating such a revolutionary reform in the methods of cooking, the inertia of the present methods would be considerable, so that the introduction of definite rules of time and temperature would take a long time.

In cookery as in photography the time and temperature methods will benefit the amateur to a greater extent than the professional, who because of his years of experience and many failures in the learning will be able to get uniformly good results with the less definite methods. Hence the greatest field for an automatic electric oven will probably be in the middle class home where the cooking is done by the housewife rather than by servants.

Summary

1. The energy lost when the door of an electric oven was opened for 15 seconds was found to vary from 5 to 15 watt-hour, depending upon the temperature of the oven.

2. The time required for roasting a rolled rib roast of beef rare, medium rare, and well done was determined for various oven temperatures, the shortest time for roasting being at 160 deg. cent.

3. The per cent. loss of weight of the roasts was found to increase with the oven temperature used.

4. The most economical temperature for preparing rare and medium rare roasts was found to be 100 deg. in each oven. For well done roasts 120 deg. cent. is the most economical temperature.

5. With electricity at \$.05 per kw.-hr. it is at least \$.02 cheaper to roast beef at 100 to 120 deg. cent. than at 180 deg.

6. It was found that at least 1,000 watt-hr. could be saved by searing the roast on top of the stove instead of heating the whole oven up to 250 deg. cent.

7. A method was devised for determining the most economical temperature for baking bread, cake, and biscuits. The minimum time for baking and the per cent. loss of weight were determined for several oven temperatures.

8. The range of oven temperatures for baking biscuits was found to be from 200 to 240 deg. cent. Starting with the oven at the required temperature, the energy used in baking biscuits is practically the same for all oven temperatures. If it is necessary to heat up the oven from room temperature, the most economical oven temperature is the lowest which will give satisfactory results, i.e., about 200 deg. cent.

9. The range of oven temperatures for baking a small size loaf of bread was found to be between 180 and 240 deg. cent. Starting with the oven at the required temperature, the most economical temperature for baking bread is between 220 and 240 deg. cent. When preheating is included, the most economical temperature for a small size loaf was found to be between 200 and 215 deg. cent.

10. The range of oven temperature for baking sponge cake was found to be between 170 and 190 deg. cent. For baking sponge cake the most economical oven temperature is the highest temperature which will give satisfactory results, i.e., about 190 deg. cent.

11. The results of the cooking requirements in electric ovens indicate that it is possible to reduce the art of cooking with electricity to an exact science. If definite rules of time and temperature were formulated for cooking each article of food, the inexperienced housewife could obtain uniformly good results with the expenditure of a minimum amount of attention and fuel.

Good Telephone Advertising

In co-operation with the Bell Telephone Company, Almy's, Limited, of Montreal, one of the largest departmental stores of the city, recently installed a "telephone window." Most traders are aware of the importance of cultivating orders by telephone, and the window in question was designed to emphasize this point and also to impress upon the public the convenience of this method of ordering goods and the adequate service given by the store. The main idea of the window is that every department is connected by telephone; this is brought out by a figure at the switchboard, and a number of instruments with ribbons leading to the number of the store featured on a large card in the centre of the window. Several small cards call attention to the various departments which can be reached by phone. On one side there is the figure of a customer about to order by phone and on the other side a miniature representation of a lady shopping at the store.

A by-law was passed on September 4th authorizing an expenditure of \$23,000 for a new distributing system in Orangeville to be connected up with the Ontario Commission's lines.

The Dealer and Contractor

First Annual Convention of Ontario Electrical Contractors—Unanimously Vote to Form Provincial Association—Delegates from all Points in the Province Unite to Further the Interests of Electrical Contractors and Dealers

The enthusiasm of the delegates to the First Annual Convention of Ontario Electrical Contractors leaves no doubt as to the necessity of the organization which has resulted. The register showed that approximately 200 delegates and guests had taken part in the proceedings. One of the most important features of the attendance was the very considerable representation from points outside of Toronto, registrations being noted from the following towns: Hamilton, London, Dundas, St. Thomas, Stratford, Owen Sound, Orillia, Brantford, Kingston, Berlin, Sudbury, Perth, Simcoe, Brampton, Belleville, Oshawa, Guelph, Windsor and Orangeville.

The prize for the largest attendance was carried off by Stratford, where there are six electrical contractors five of whom were in attendance at the convention.

Probably the most important item of business was the formal organization into an Ontario Electrical Contractors' and Dealers' Association, with the appointment of the necessary officers. The voting for the various offices resulted as follows: President, Mr. J. W. Commeford, Toronto; first vice-president, Mr. H. W. Greenleaf, Belleville; second vice-president, Mr. R. E. Zannoth, Windsor; treasurer, Mr. M. S. Soulles, Oshawa; secretary, Mr. R. D. Earle, Toronto.

The proceedings opened on Monday afternoon in the convention rooms, No. 2 College Street, with a good representative attendance. Mayor Church and various members of the Board of Control and of the City Council were on hand to welcome the delegates to the city.

Organization and Its Merits

To Mr. E. A. Drury, Toronto, fell the honor of presenting the first paper. Mr. Drury took for his topic "Organization and its Merits, with Particular Reference to our own Organization." Mr. Drury's paper is printed below. Coming, as it did, at a time when the delegates were considering the question of organization with an open mind, Mr. Drury's presentation of this matter exerted a very wide influence on the organization proceedings which were so successfully carried out a little later in the day, when the above officers were selected.

The papers throughout must be considered of a very high order, and the discussions were highly intelligent and animated, demonstrating the fact that there are many very forceful speakers in the electrical contracting profession.

Mr. J. W. Commeford presided throughout with credit alike to himself and the association. Mr. Commeford also acted as chairman at the Banquet on Tuesday evening where the contractors and their friends, which included representatives of the City Council and Board of Control, the Toronto Electric Light Company, the Toronto Hydro-Electric System, Hydro Electric Power Commission of Ontario and other prominent organizations, spent a most profitable and enjoyable time. No thought or expense was spared in making the evening as full of sociability as possible. Everybody had a good time.

An outstanding feature of the Convention proceedings throughout was the very noticeable unanimity, the friendly relations, existing among the different delegates, although in many cases they were keen competitors with one another. This promises well for the success of this organization.. There are some things, of course, which we do not care to discuss with our keenest competitors, but there are many points in the electrical contracting field which represent troubles to all contractors alike, and nothing but good can come from heart to heart talks and an exchange of experiences, having in view the removal of these troubles. One of the difficulties of the electrical contracting profession in Canada up to the present time has not been so much that the difficulties were not recognized, as that there has been no organization ready to use their influence towards rectifying these evils. We foresee in the new Association an era of very greatly improved general conditions for the electrical contractor, and much more workable relations between the contractor, the dealer, the jobber, the central station and the manufacturer.

Talk on Advertising

Mr. Frank H. Rowe, of the Toronto Advertising Club, gave a most interesting talk at the Monday evening session on the advantages and possibilities of advertising. Mr. Rowe explained that advertising is no longer a game of chance. Dividends are as certain from investments in advertising as any other investments, if the same care is taken in spending your money judiciously. Quite too often, it is true, the wrong medium is used or "copy" is not as attractive or otherwise well worded as it might be. Where a dealer or contractor is spending money for newspaper or other forms of advertising and does not appear to have the special knack of making his advertisements bring in the desired result, Mr. Rowe strongly advised the employment of skilled advertisement writers.

A number of very helpful suggestions were made by the speaker, one of which was the use of a large and attractive card in connection with window displays. For example, Mr. Rowe suggested that a card, say 4 ft. x 2 ft., having an item of news telling the number of towers carrying the high transmission line between Toronto and Niagara Falls would be of sufficient interest to halt the ordinary passer-by. The large card has now served its purpose and the passer-by having stopped to look at the card will next look the window over and very possibly find something of interest. These cards should be changed frequently. Give the passer-by the impression that there is always something new going on in your store, and if possible get him into the habit of expecting to find a new window display periodically, once a week

say, or if possible every day. It is cheap advertising and one of the most effective.

Society for Electrical Development

Mr. Geo. W. Hill, of New York, was present for the Society of Electrical Development, and explained at length the aims and accomplishments of that Society. The keynote of his address was "co-operation" and he instanced many cases where contractors might improve their working conditions by closer co-operation among themselves and with the dealer, central station, the jobber and the manufacturer.

A Proper Accounting System

One of the most important addresses was on the subject of a proper accounting system for electrical dealers and contractors. The Association is indebted to Mr. Jones of the Cleveland Electrical Contractors' Association for a talk on this subject and an illustration of a very simple though complete system that has been found to work out satisfactorily in a large number of cities and towns in the United States. A sample of the forms and books necessary was left with the secretary of the association and will be available for inspection by any Canadian contractor who may be interested. Mr. Jones emphasized the necessity of an accounting system for a contractor being simple in its operation. A systematic system of accounting is none the less important, however. Especially he emphasized the necessity of looking after the item of over-head expenses. Quite often one meets an electrical contractor who deludes himself with the idea that he has no over-head expenses. Mr. Jones, however, feels that there is no such contractor in existence and this opinion, we believe, was generally shared by the delegates present. The items particularly emphasized by the speaker which must be taken into consideration, and which can be so worked as to include all other items, were time, material and over-head.

Hydro Inspection Rules

Mr. H. F. Strickland, Chief Inspector of the Hydro Electric Power Commission of Ontario, made his first public appearance since his operation for appendicitis and received an ovation. The delegates kept Mr. Strictland busy the greater part of one morning discussing and answering questions on points in dispute in connection with the rules and regulations of the Commission.

Workmen's Compensation Act

The Workmen's Compensation Act of Ontario as it affects electrical contractors was discussed by Mr. E. M. Trowern, secretary of the Retail Merchants' Association of Canada. Mr. Trowern placed himself on record as unalterably opposed to the Workmen's Compensation Act, as he considered it one of the most iniquitous pieces of legislation ever placed upon the statute books. In connection with this same question Mr. Hinsdale, advisor to the Workmen's Compensation Board, very kindly attended one of the sessions to explain the working of the act and to answer any questions regarding the interpretation of the act in particular cases which had come to the attention or the experience of any members present. The opinion was expressed by more than one delegate that electrical contractor employers were not properly placed in class 38, which includes large central stations where men are exposed to the dangers of high tension lines and complicated switching arrangements.

Electrical Employers' Association

Mr. Maclachlan, speaking for the Electrical Employers' Association, of which he is secretary, gave statistics to show that though the percentage of electrical contractors in this class (Class 38) was only approximately 15 per cent. of the total—their fatalities since the act had been in force had been 40 per cent of the total—in other words 2 out of a total of 5. It was pointed out, however, by both Mr. Maclachlan and Mr. Hinsdale that if at the end of the year the electrical contractors were found to be linked up with a class that showed greater hazards than the electrical contracting class alone, adjustments would no doubt be made so that the electrical contractors would be placed on an equitable footing as far as premium payments were concerned.

An interesting point was raised by one of the delegates as to the working of the act in case of a transfer of control from a private company to a municipal corporation, or vice versa. Who would carry the load of the payments after the transfer was made? Mr. Hinsdale made it plain that the Act would be interpreted to place this load on that class to which the party in control belonged at the time the accident occurred.

Value of Trade Magazine

Mr. G. C. Keith read an interesting paper on "The Relation of the Trade Magazine to the Trade and to the Electrical Contractors' Association." Mr. Keith pointed out the value of a Trade Magazine in distributing information of new equipments, new methods of installation and organization, systems of accounting, reporting convention proceedings, and so on. Progress along nearly every electrical line is taking place at such a rapid rate that one cannot hope to keep pace except through the Trade Magazine which presumably keeps in touch with the latest developments and presents these to its readers in brief and easily digested form.

Do It Electrically

A paper on "Do it Electrically" presented by Mr. Walter Carr contained a number of suggestions looking to the more extended use of electrical equipment, particularly in the home. The paper pointed to the necessity of contractors using always their best endeavors to make their installations as complete as possible having in mind not only the requirements and demands of the present day, but keeping prominently in view the fact that if the next few years show an equal development with the last few in electrical progress, electricity in the home will become infinitely more general and the demands for electrical appliances and the importance of using electrical appliances will have become much more urgent Referring to the cost of electric cooking, for example, it was pointed out that general impressions regarding this matter are usually in error, and figures were quoted showing the average of some forty families in Toronto varying in number from 2 to 7 persons each. These figures showed that the average consumption including cooking, lighting and all other ordinary household uses of electricity average only 20.5 kw.h. per person per month, or at the rate charged in Toronto at a cost of 35.4c. per person per month. These figures would seem to dispose entirely of the contention that cooking by gas is cheaper than cooking by electricity.

Other interesting papers which are produced below, either in complete form or copiously extracted, include a discussion on "Licensing Electric Contractors," by Mr. F. C. Whatmough, Stratford; "The Relation of the Jobber to the Dealer and Contractor, and the Jobber's Function in the Trade," by Mr. C. A. McLean, Toronto; "The Re-sale Problem," by Mr. Geo. T. Dale, Toronto.

No report of this convention would be complete without mention of the excellent exhibits displayed by a number of jobbing firms during the convention dates. These included attractive displays by the Flexible Conduit Company, Guelph; P. N. Wettlaufer; Norton Telephone Co.; Metropolitan Engineering Co.; Factory Products; Canadian General Electric Co., Northern Electric Co., and Canadian Carbon Co.

Organization of Contractors and Its Merits

With Particular Reference to our Organization

By Mr. E. A. Drury*

I think this meeting has demonstrated the need of an organization. The first need in an organization is to know each other. We who compete with each other and who work in the same line of business under the same conditions, if we know our competitors and if we have a good feeling towards them, naturally meet a rosier side of the situation, and we remember some of the good points and forget some of the bad points that we would otherwise see.

The power companies to-day have an enormous investment, and they realize they must sell their power in order to get returns, and that wiring and the other things incidental to their business must be done by us or somebody else, and they are having it done and in some cases leaving us out of account altogether, and we are being forced to the wall. It has come to the point where we must either organize and do the work that they are doing better than they do it or go out of business. The power companies go to the manufacturers and induce them to use electric power, and they want to get it installed. The point is the power companies are not going to stop there but they will see that they are using it, and we must show the power companies that we are the best people to do this work. That is a question that must be solved by the electrical contractors as a body.

We have to-day in the province of Ontario an inspection department which makes rules and regulations for the whole province, and the Toronto man knows what he wants, the Hamilton man knows what he wants, the St. Catharines man or the Ottawa man knows what he wants, but there is no organization behind us and we have not settled what is in the best interests of all of us, and the consequence is if anyone in the province wants to get any legislation passed he is met with obstruction from sources where he should receive help. For instance, in the city of Toronto some months ago the Provincial Commission started to enforce their rules our way and get a great many of the electrical contractors said, "here, you are going too far, you are not doing this thing the right way," and when we saw some of them about it they said "why didn't you tell us this was going to happen, why didn't you do something for us?" Now, we did not know who the contractors were and we could not chase around every place after them.

Study the Laws

Then we should become conversant with the law. If we have to keep the law it is up to us to shape that law to suit our own interests, to suit the interests of the electrical contractors. You cannot do that alone and neither can I, and neither can the man in any other place, but we can do it as a provincial organization, and when they come to enforce the law they have the contractors behind them. We realize it is to our financial interest to see a law put in a a position so that it can be enforced. We realize to-day that the inspection department is and should be a help to the legitimate electrical contractor.

Then another thing, if we meet together and you get my viewpoint and I get your viewpoint we can come to an understanding as to which is the proper way, and then when we go and ask for something we go as a body, and we have more chance of getting what we want than if we go individually.

There is another question which I might touch on and which will be brought up later, the question of workmen's compensation. The vast majority of the contractors, the same as the other people in the province say they are in favor of workmen's compensation, but the point is, are they in favor of the law as it is on the statute book to-day? Do they understand the position of the law to-day, and how their interests are protected? We cannot go into this question individually, for it is too complicated for many of us to understand. With an organization we can appoint a committee to go into the matter and we could clearly understand it, and we could then go to the Legislature and ask for any change that we thought wise. I am satisfied after the electrical contractors look into this matter they will realize that the law is not in their interest. They are placed in a class with people who should not be in that class, and it is up to us to organize and appoint somebody to look into this question, and when we go to the Legislature they will know there is power behind us.

Consumer Buys from Wholesaler

The electrical contractor to-day buys his material from the wholesale houses to sell again. That is one of the ways that he hopes to make a living, but you all know the customer can go to the wholesaler and buy the material as cheaply as you can, and the consequence is the contractor is prevented from making anything on the material, and in some cases it has forced good men to the wall. Now, we want to show the people who sell us goods that we are buying the greatest percentage of their goods, that while they may be able to sell ten or fifteen per cent. of their output outside they sell 85 per cent. to us, and if they do not play fair we will certainly not play fair with them. We want to show them that we are a power and we will use that power in order to get what is right, and the way to do this is to have an organization.

Then there is another important question. We compete to-day with men who do not understand about financing their business. They do not know where their profits come from or how their losses come about on account of the crude method of bookkeeping they are following. We cannot give the best accounting system in one afternoon, but we can show the contractor how very necessary it is for him to understand what margin is necessary for him to carry on his business, and when you get him to understand that you have got a man who understands what he must have in order to stay in business instead of having an unfair competitor you have a man that you can meet on an equal footing. I think myself if this convention does that one thing, educates a man who desires to play fair but who does not know how, to play fair, it has accomplished a great deal. I do not myself understand bookkeeping very well, but I know that it is necessary for me to put something on for my overhead expense, and it is up to me to study the costs a little more to become conversant with that department. When a contractor gets to understand this then he is in a position to do business honestly and squarely with all.

We are somewhat different from the other retail trades. A man only buys hardware when he needs it, or any other commodity on the market. What we have to do to-day is to convince people that they need everything electrical. We want to show them the devices that are on the market, and we want to convince them they are absolutely indispensable and they must have them. That is the only way we are going to stay in the business, but you understand you can-

* Read before Ontario Electrical Contractors' Convention.

not do it alone, and I cannot do it alone, but through an organization we can. By organization we can do this thing far better than it has been done in the past, and it will give us far better results. If we do not do it the power companies are going to do it. I think I can say candidly, in Toronto there are very, very few real electrical jobbers. The Hydro and Toronto Electric Light spend possibly thousands of dollars organizing their concerns and demonstrating electrical devices because they realize what is coming back to them. Now, instead of having one or two show rooms they could have hundreds of show rooms where electrical devices could be shown to advantage, and they would have our stores inducing people to use those goods. They would gain more by the organization of our craft than any other person, and we would gain because we would demonstrate our usefulness. It is up to us to do this. The supply houses to-day show electrical devices in their windows that are sold by manufacturers who make no effort at all to sell to us as retailers because they know a retail man is not going to sell an iron if he only makes 15 or 20 cents. When the contractor knows he is only getting 15 cents out of every $3.00 he says "nothing doing." We have got to show these manufacturers that we are the market, we are the people who are going to sell their goods, and if they do not play fair with us they will not be able to sell any of their goods. As soon as we demonstrate to the manufacturers our ability to sell I am satisfied they will not only help us but will boost us in our endeavor to sell their goods.

Then throughout the province of Ontario I am sure there are thousands of places yet unwired, and these are good prospects for us who desire to wire them. The building trade is practically dead and we need more business. Now, if I go to that man who has a house that needs wiring or write a letter to him and go to a lot of trouble to induce him to wire it, or get the tenant to get after the landlord, the chances are after all my trouble and spending perhaps five or ten hours at it Bill Jones will get the job. It is the work of an organization to do this work and some of us get the job and we will get the benefit. I am not doing the publicity work alone and neither are you, but we can get together and we will gain by this publicity, and we can get after the old house wiring work as it has never been done before.

Get After Un-wired Houses

I want to tell you if we do not get after this kind of work the power companies will. They have the poles strung along the streets and it is not a great deal of expense to put in the extra service. I have known places where the power companies have wired the houses free of charge. Just think of the amount of wiring the power companies are doing both in Toronto and elsewhere free. I am told the Toronto Electric Light are supplying lamps free. Now, this has to be

Group of members (only) attending first convention of Ontario Electrical Contractors.

stopped when you can stop it or you won't be able to stop it at all, and that means organization, either we have to organize and do something for ourselves, or they will do it. Possibly some contractors will say, oh, we do not want house wiring, but they do want factory wiring. Now, just as soon as you convince people that electric light is a nice thing to have, just as soon as you convince them that the electric iron is a boon, and the electric vacuum is a comfort, and the electric washing machine is a dandy, they will advertise it to their neighbors and induce them to buy these things; just as soon as you show them that everything electrical is a necessity, just so soon will you show the manufacturer the absolute necessity to install electric apparatus in his factory. I do not think I would be out of my count if I said three-fifths of the factories in Toronto did not have electric wiring in them. Now, there is not a factory in Canada that has not some use for electric power, and it is up to us to show them its uses, it is up to us to demonstrate its cheapness, and the more they use the cheaper it will be. There is not more than one bakery in Toronto with electric power. One fellow has got it, and we have to demonstrate to the other fellows they must get it too or get out of business. We must get after all these institutions as they have not been got after before, and we can only do this properly by having an organization. We can spend a small amount of money individually and get greater results from it in that way.

Must Organize

I think you all realize how absolutely necessary it is that we should get together, but it is no use saying we must get together and walking away. We must get together and organize, and I will move that the electrical dealers and contractors of the province of Ontario organize in a provincial association for mutual benefit and protection and that a committee of three, together with the mover and seconder of this resolution be appointed to consider the details of such organization and present a report with recommendations to the afternoon session on Tuesday.

The motion was seconded by Mr. Zannoth, of Windsor, and the President put the motion, which was carried unanimously.

In supporting the motion Mr. Zannoth said he was glad he had come to Toronto to attend the convention and how glad he was that an organization was in progress. He said he thought education was a paramount need in such an organization so that the contractors and dealers would conduct their business in a profitable manner, and not only conduct it profitably but squarely, so that every man in the organization would have an equal chance to get the business. He was not in favor of setting a scale of prices but was strongly in favor of the organization undertaking the education of its individual members so that each one would know how much it was going to cost him to do a certain work and to include in that cost his overhead expenses. He had, he said, heard murmurings of dissatisfaction all over the province on account of the plan adopted by various power companies of putting in a line of appliances and selling them at practically cost, thereby preventing the legitimate dealer, who had to pay his taxes and dues to the government, from undertaking the work with a margin of profit. It could not be said that the power companies were not properly looking after their own interests, but it meant that the dealers and contractors must give better service. He did not mean that the contractor did not do good work but there were a great many things in the way of electrical installation that he might push which would increase consumption and give consumers more satisfaction than they were at present getting. There were, he said, a great many other uses for current than for lighting purposes and the dealers and contractors should bring this to the notice of the consumer and in this way give satisfaction to the power company in the district. He sincerely hoped that the organization would be a success and not be one in name only, and he felt sure that many good results would be accomplished.

Mr. Greenleaf, of Belleville, Mr. Smith, of Perth, Mr. Martin, of St. Catharines, and Mr. De Guerre, of Oshawa, were appointed a committee to report on organization.

Relation of Jobber to Dealer and Contractor

And the Jobber's Function in the Trade

By Mr. C. A. McLean*

This subject as you will note is divided into two clauses, and I will discuss first the latter clause which is the jobbers' function in the trade, meaning to the electrical trade. Present day conditions are such in the electrical trade, as in other trades that no middle man can successfully continue in business who does not fill a real want an do a real service, and to many of you it may appear there is little justification for the jobber in the electrical trade to-day. It may seem the manufacturer can deal to better advantage direct with the trade. Such, however, is by no means the case, and the most convincing proof of the usefulness of the jobber lies in the fact that those manufacturers who are making good in the electrical line seek to market their product through the jobber, and the stronger and better known they become the more they insist on marketing their goods through this source. There are several reasons for this attitude. The jobber buys their products in standard packages or multiples of standard packages which means fewer shipments and less costly packing. Then they find they can confine their business to a small number of large accounts rather than to a large number of small ones, and their credit risks are reduced to a very small margin. Then they can employ fewer salesmen and yet adequately cover the distribution of their product over a wide territory. Deliveries from the jobber's warehouse are much quicker than from the factory. These substantial savings will repay the manufacturer for whatever margin of protection he gives the jobber. Without the jobber he knows the trade prices would have to be raised to cover the extra cost of selling.

Turning now to the functions of the jobber to the electrical trade we find in the first place the jobber is a merchandise distributor. Goods that appeal to him as saleable are brought from Canadian factories and American factories and even from Europe, and through his salesmen their merits are put before the trade in his territory. The dealer's investment in merchandise is more than cut in two by the jobber, because whereas the dealer would have to order from the manufacturer in standard packages or pay exhorbitant prices on broken packages he may order from the jobber his fortnightly or weekly requirements in any line, and he may combine everything he needs in one shipment, which means a tremendous saving in freight rates and frequently in duty. It may appeal to you as contractors to be good policy to buy direct from the manufacturer, but before you do so count the cost. There is the extra freight

* Read before Convention of Ontario Electrical Contractors.

and, if a foreign shipment, there is the cash tied up in duty before you ever see the goods, and there is the capital you tie up in buying standard packages where smaller quantities would serve your requirements, and in some cases, especially in purchasing from American factories, it is cash on delivery instead of the regular 30 day terms you get from the jobbers.

Not only is the jobber a merchandise distributor but he is the trade's best banker. Weeks ahead of your requirements he has invested his money in goods for you which he feels you will need sooner or later, and if he feels satisfied you will pay him, the goods are yours to sell thirty days before he expects his cash back, and frequently carries it over for another thirty days, and not only that but keeps on selling you more goods and keeps a smiling countenance. If you go to your banker asking for extensions and trying to work in an overdraft on top of that you can imagine what will happen. The jobber is a banker for the trade the same as you on your part are bankers for the consumer.

Jobber is Advance Agent

Then again the jobber is the advance agent of new lines. His salesmen are your personal friends if he selects the right kind of men, and we as wholesalers owe a debt of gratitude to the salesman. Being an ex-salesman I know the path of a salesman is not a bed of roses, and you should treat them in the best way you know how. Anything that promises well these salesmen are anxious to lay before you and discuss its merits with you, and they show you how to make a profit from the use of it, and without the salesmen the advances in the electrical trade would be very slow indeed, so slow that the manufacturers would hesitate to bring out new lines.

Then to come to the relation of the jobber to the trade we will discuss relations which need improvement. The other relations do not need discussing. In the first place I take it that it matters not so much what price you pay for an article so long as you are satisfied that your competitor cannot buy it at a better price. Certain contractors in Canada by virtue of their long established business or for some other reason have secured from certain manufacturers prices that are ordinarily given only to jobbers. This is unfair both to the legitimate jobber and the legitimate contractor, and if that manufacturer is not willing to admit the principle of selling through the jobber only he should be willing to accept the opposition of the rank and file of the electrical trade, and he should not expect the jobbers to push his lines. His discrimination in favor of some one contractor or two contractors is likely to mean the loss of valuable contracts to other contractors who are not in a position to figure so low because of the greater cost of the material to them, and the goods of such a manufacturer are unsafe for both of us to handle for that very reason,, and properly they should be under a system of boycott by the legitimate contractor and legitimate wholesaler.

Consumer and Jobber

Again a complaint has been made that consumers are able to obtain prices from jobbers that did not allow the trade a sufficient margin of profit, which means they do not get sufficient protection. The annual purchases of some consumers exceed those of the average contractor, and these are able to obtain prices from American manufacturers and wholesalers, and it is a pretty difficult thing to give the trade a margin of protection with that class of consumer. However, that matter is not so vital as protection in the case of small consumers, because these large consumers usually maintain their own electrical staff and do not let their work out on contract. With the greater proportion of our annual business with the smaller consumers it is, however, possible to adequately protect the trade, for wholesalers in general who are willing to protect the trade will themselves establish a reasonable standard of prices to which they will adhere when quoting on stock items. This matter I believe, is to come up later for discussion.

Sometimes contractors fail to employ a proper policy with respect to the jobber. They spread their purchases amongst the jobbers and manufacturers, mail order houses and small factories, or wherever it may for the moment suit them to buy, and their business standing in any one of these houses is of small account. When the opportunity comes to secure a large contract they frequently have difficulty in securing the proper amount of credit because their ledger record only shows small and scattered purchases. It would seem to me to be sound policy on the part of an electrical dealer or contractor to select one or more good responsible jobbers and to purchase from them conscientiously, and by watching that account carefully with respect to settlements, and making settlements promptly, and paying interest on overdue accounts, etc., establish a credit standing which will be a most valuable asset. Your stock may grow steadily or your customers may be slow in payment, or trade may be dull, but so long as you have a good line of credit you do not need to worry.

This matter of credit is a most serious question. Rightly or wrongly the electrical business, particularly the electrical supply business, is classed by the banks as one of the building trades and they consider its fortunes are bound up with the building trade. This is not the case. It is not necessary to state the banks have shut down on the speculative builder, and we as wholesalers are not inclined to furnish indirectly or directly goods to the speculative builders, and I would earnestly warn you to investigate very carefully the financial position of every builder from whom you contemplate taking a contract. The banks have become very careful and it is increasingly hard to obtain accommodation from them, all of which means that the wholesaler will have to insist on 30 day terms, and that you as contractors will have to investigate the standing of your customers more carefully so that you may be prepared to meet your bills promptly. We feel we will have to work together for the next year or so with the idea of maintaining our financial position intact and showing the banks that the electrical trade is in a position to go ahead and flourish in spite of the depression in the building industry. Once we have done that we have gone a long way to establishing the status of this business in Canada.

Selling to Large Consumer

In answer to a question by one of the delegates as to the manufacturers selling direct to large consumers Mr. McLean said, "I was referring to the C. P. R. and G. T. R. and such concerns whose purchases are so large that it is difficult for even the wholesaler to sell them. I am not criticising the policy of the manufacturer in selling to the trade, but it is the policy of selling certain members of the trade at jobbers' prices, not that the wholesaler loses so much business thereby, but it is unfair to the trade in general. If on a certain job he makes a saving of $50 in the purchase of certain goods that are specified he is in a position to bid just $50 below you and make an equal margin of profit. I think the manufacturer should be open to reason on that point. If he will not adopt either one policy or the other, either sell direct to the trade and carry the number of accounts involved, or sell directly to the wholesaler, then it seems to me that his goods should not be pushed and sold by either the contractor or the jobber. The question of resale prices to consumers by the wholesaler is one which I believe is to be taken up in a subsequent paper, but speaking for the wholesalers in Toronto, we are just as

anxious as you that something definite should come of this and that a working basis should be arrived at whereby these objectionable features shall be eliminated. We are leaving it to you to come across with something that is workable, and I think you will find we will be responsive. (Applause).

The President expressed his pleasure on hearing that the jobbers were willing to meet the dealers and contractors. He stated that in the near future a committee would be appointed to confer with the jobbers and their representatives on this question. He cited an instance where a contractor did some work amounting to about $200 for material supplied to which he added 30 per cent. The gentleman who received the bill sent it on to an electrical engineer, who in turn went to the wholesale houses and asked them for their closest prices. As a matter of fact he got a lower price for some of the material than the contractor paid for it, which was hardly fair, and all the contractor got was a few cents on his time. He hoped that when the jobbers and contractors got together some arrangement could be made to overcome this difficulty.

The Re-sale Problem—And Its Effects

Direct Sales to Public Unfair to Contractors

By Mr. George T. Dale*

The question that I have been asked to deal with in this paper arises from the unsatisfactory manner in which the jobbers handle their direct sales to the public.

We have found in Toronto that certain firms sell electrical goods in small quantities, to the public, at practically the same prices they do to the trade in bulk. I think that practically every member of this local section has suffered more or less from this unfair practice. To some of us it has been, and is, a very serious matter. It has not only affected those members keeping retail electrical stores, but has made our members take contract and time and material work at unprofitable prices.

The jobbers have travellers who call on every possible customer, on the manufacturers, the storekeepers, and even on the householder. In fact, one house even went so far as to send a circular letter broadcast, showing a list of the material necessary to wire a six room house. The price for these materials was in some cases less than our members were buying at. I have this letter with me. It reads as follows:—

Jobber's Letter to Consumers

Gentlemen:—

We wish to announce that we have opened up a high class Electrical Supply House at the above address, and are carrying a full and complete line of supplies, fans and motors.

We are offering very special attractive prices on the following supplies, which are good only until July 1st for $30 net:—

1,000 ft. No. 14 New Code S. B. Wire; 500 Split Knobs; 500 3½ in. x 5/16 Alphaduct; 12 Single Pole Flush Switches; 6 Three Way Flush Switches; 250 ft. ½ in. Alphaduct; 1 Two Circuit Detroit Box Complete; 20 ft. ½ in. Conduit; 1 F. Condulet with cover; 50 ft. No. 12 D. B. New Code Wire; 1 gross 3½ in. x 9 Screws; 12 Union A. Boxes; 6 Spacers; 18 Solid Brass Switch Plates; 3 ½ in. Pipe Clips; 1 1½ in. Ground Clamps; 1 lb. Friction Tape; ½ lb. Rubber Tape.

We trust you will take advantage of the above opportunity and favor us with an order.

Assuring you of prompt delivery,

We remain,

Naturally the householder would think these were ordinary retail prices leaving a legitimate profit to the contractor or dealer. He would compare these prices with any tender he received for such a job and decide that the contractor was trying to overcharge, for no contractor could lay out his money for these materials, wait for his collections, take the ordinary business risks and sell at anything like the prices quoted.

Builders getting hold of this list would naturally decide to buy the materials themselves and employ a man to do the work. Unfortunately we find this only too easy for them to do. Many electricians are even making a practice of soliciting business of that nature. They tell the customer that he can save money by buying his own material and paying him to do the work. They will even look over the job, and make out a list of materials required free of charge. My firm had a time and material job with a printing firm in this city. Part of the work had been finished and invoiced. When they were ready to have the rest of the work done we started on it, but one of these men came along with this "purchase your own material scheme" and the work was taken away from us.

If this printer, who by no stretch of the imagination was entitled to trade prices, had had to pay retail prices for the materials, there would have been no incentive for him to take his work away from the legitimate contractor. Not only did we lose the balance of this work, but it has made it difficult for us to collect for the work done.

I am citing this, and other instances in connection with our own business because they are the same problems that you have to deal with, every one of you, and I want you to realize just what it means to you.

Customer Gets Prices from Jobber

Two years ago we put through a time and material job for one of the large local oil firms. The materials ran into nearly $500. About a month after it was invoiced we received a 'phone message to send a representative to see their superintendent. It sounded as though there was another job for us there, so I went down personally. Instead of getting another job I gave away about $75. That superintendent had called up the different jobbers and gotten prices on the goods in our invoice and on the same quantities. He showed me this list of prices. Some of them were below our quantity cost price, others a few per cent. more, but all far below our invoice price to them. Naturally he was a pretty wild superintendent, but fortunately for use he was fair minded and open to conviction. I was able to partially convince him that he was given trade prices, he acknowledged that we were entitled to a profit, but not the prices we had asked. He could not realize that the overhead in contracting business is very high. In the oil refining business the work is largely automatic, pumps are started and left to do their own work, pipes are connected from vat to vat and the oil left to flow. There is a continuous arrival and departure of oil, and naturally the overhead in their business is distributed over huge quantities of material so that the percentage of overhead is very low.

We had to give him the goods at a price that barely cleared our cost of operation, allowing us no profit, and as they are a large firm, an important customer, we have had to do their work on that basis ever since in order to hold them until such time as the present resale conditions are

* Read before Ontario Electrical Contractors' Convention.

rectified. It should not have been possible for that superintendent to get trade prices. If proper prices had been quoted him there would have been no discussion of overhead and we would have received the prices we asked for without question. This one instance, and the jobs we have done for him since have cost us about $300 roughly in the last two years.

This Work Belongs to Us

You see the way this mounts up. This loss of legitimate profit is on one firm's business only. It must be losing us, losing you, thousands of dollars yearly.

Do you realize that there are thousands of manufacturers employing their own electricians because they can buy their electrical goods wholesale. You should be getting this work. It used to be yours, you've lost it and we must get it back and hold it. Is it any wonder that so few electrical contractors are really successful?

This condition does not affect the contractor only. Those of you who have retail stores would be able to sell more goods if you had the proper backing from the jobbers. The goal we should strive for is "The Electrical Jobbers Sell to the Trade Only." Does that printer go to the boot and shoe jobber to get his carpet slippers? No, he must go to the retailer. If a manufacturer finds it necessary to do some of his own electrical work he should go to you storekeepers for his materials.

This question is one that vitally affects every contractor and dealer in the province and there should be such unanimity that the jobbers would not dare to sell in the retail field.

In reference to the oil company and harness company mentioned before, I wrote each of the jobbers this letter dated February 23 and in every case received replies. I will give you extracts from these also, omitting names. Now here are the replies:—

Letter to Jobbers

Gentlemen:—

About two months ago we completed a pretty fair sized job for the ———— Oil Company. We were doing this work on time and material basis. When we sent in our itemized invoice the superintendent of the oil company called up the different electrical supply companies and got prices on the goods that we had invoiced them with. He then called me up on the telephone and requested that I go down to see him. When I did so he placed before me prices which were practically identical with those that we had paid for the material supplied. It took a lot of talking to convince him that this was so, in fact he has never been entirely convinced of that. The final outcome of it was that I was reduced to the necessity of settling with them on a basis which left me a considerable loss on the job, when organization and overhead expenses were figured in on the cost. This is a direct outcome of what I class as unfair business on the part of the supply houses that quoted the prices.

I determined at that time that another such instance would make it necessary for me to discriminate in placing our orders, to the end that we would deal only with those supply houses giving us fair protection. I very much regret to find that that time seems to have arrived.

On January 27th we invoiced the ———— Harness Mfg. Company with a job done under the same conditions—that is, time and material. It seems from a letter written by them on February 19th that they have likewise got prices for the material supplied from the supply companies. These are as follows:—

Reinforced Cord	per 100 ft.	$3.00
5½ Split Knobs	per 100	1.00
No. 14 R. C. Wire	per M. ft.	8.50
3/8 Key Sockets		.16
3/8 Bushings	per 1,000	4.80
2 wire Moulding	per 100	1.50

and this was for only a comparatively small size job. The prices above, that they have received, are in some cases identical with those that we get from you, in others practically the same, and the case of the 3/8 bushing less than one-half the price that you are charging us. And yet, in the course of a year we buy hundreds of times what these firms do, and the popular use of electricity and consequent use of electrical supplies is largely dependent on our efforts and the efforts of firms like us.

You will have to acknowledge that this discloses a state of affairs that cannot continue. It seems to be peculiar to the electrical trade only. I have not heard of any such conditions pertaining to the other trades.

I am writing this same letter to each of the other supply houses of importance in the city, and I am asking them as I am asking you, the following questions:

Did you quote the ———— Harness Mfg. Company the above prices?

Do you make a practice of quoting these prices or similar prices to the consumer?

Do you invariably quote prices which give the contractor and retailer a fair protection?

I would very much like to have an answer to these questions within the next few days and I am enclosing a stamped addressed envelope to make it convenient for you to let me have it. You must agree that the statements above are sufficient justification for this letter and for my proposed action on the result of them.

This letter is not written with the idea of being impertinent or interfering unduly with your business policy, but because I earnestly believe it necessary to the self preservation of this firm.

Please do not treat this matter lightly, we are quite serious in it. Further, to the above I am considering the advisability of sending a copy of this letter and a copy of the replies received to all of the contracting companies in the city. It will only be fair to the other supply companies to surmise that those who do not answer are not prepared to give us the proper protection.

Yours respectfully,
The Electrical Maintenance & Repairs Co., Ltd.,
Per Geo. T. Dale, President and Managing Director.

Extracts from Replies Received

I.

"We find it necessary, in order to meet existing competition, to quote practically the same prices for equal quantities to everyone having a satisfactory credit rating. If we did not do this our competitors would simply walk in and take the business away from us, and while we agree with you that bona fide electrical dealers and contractors should have a reasonable protection, the problem of establishing definite rules governing such protection is a very difficult one.

"You, of course, appreciate that certain large firms like, for instance, the Massey Harris Company, maintain their own electrical staff and do their own work, and that such firms not only buy in large quantities but their aggregate annual requirements are in excess of a great many electrical contractors. Even if every jobber in Toronto agreed to charge such firms higher prices than firms in the electrical trade, it would only result in driving the business out of the city or out of the country.

"It is also very difficult to determine where to draw the line between legitimate contractors and dealers and the numerous day labor men, who have no office, shop or store, but who take contracts and buy material for use in connection with such contracts. We assume that firms like your own would object to equal rates to such firms."

II.

"I have your letter of February 23rd and wish to advise

that we have quoted neither of the companies mentioned in your letter.

"The prices that we quote to the trade and general public are for the most part ones that are established by the manufacturers, and are largely based on quantity purchased at one time, the assumption being that the electrical dealer and contractor is in a position at all times to purchase electrical materials that he is constantly using in larger quantities, so as to get the very best prices."

III.

"In the matter of a fixed resale to large consumers, this company would be glad indeed to maintain any resale which was established by the majority of the electrical contractors, providing said resale was agreed to and adhered to by contractors themselves and also by the other supply houses. So long as the contractors have no established resale prices, and so long as they continue supporting those houses who openly compete with them in the sale of material to the large users, this company, in self-defence, must quote the same user the best prices it can obtain under the circumstances."

IV.

"In answering questions: Did we quote the ———— Harness Co. the above prices—We did not.

"Do you make a practice of quoting the prices or similar prices to consumers—in some cases at the present time we do.

"Do you invariably quote prices which give the contractor and retailer a fair protection—we have been endeavoring to do this in nearly all cases and have lost considerable business by doing it.

"We would like very much to see an arrangement of prices where the contractor can bill a time and material job and get a fair profit, and we are going to try to take this question up through the electrical section of the Board of Trade. You, of course, realize at the present time, as far as we know, the contractors have no standard price for selling material on a time and material job, and this would have to be established."

V.

"Considering in the first place your direct questions, we might state that we did not quote the ———— Harness Manufacturing Company on this material at all. However, we are perfectly frank in stating that had we received the inquiry we would have quoted direct at prices approximately those you have named.

"We are quite in sympathy with the view you take of the situation, and we quite realize the principle on which you are working.

"You ask if we invariably quote prices which give the contractor and the retailer a fair protection. We must frankly state that we do not, if you consider large factories as retailers. With the exception of such electrical devices as heating apparatus, flashlight goods, etc., where there is a direct demand from the general public, we have only one set of prices. On such goods as we are forced to receive this retail business we quote list prices.

"We are perfectly willing to consider any feasible plan of co-operation with the contractors as we appreciate the business which we receive from the contractors, and are, naturally, willing to work with them.

"Returning to the original point of argument, however, we repeat that with the exception of those articles which are in demand by the general public, we have but one set of prices, which vary according to quantities, and until the contractors take steps in this matter themselves we cannot see how any difference can be made in the present conditions. It is our belief that the only way in which a better condition of things can be brought about is for the contractors to form an association of sufficient strength, either throughout the city or throughout the province.

"The first steps for betterment of conditions rest in the hands of the contractors, or a contractors' association. We are certain that the supply houses are willing to co-operate with the contractors in any feasible solution of the present situation."

Toronto Organization

We of Toronto formed a local committee, of which I was appointed chairman, to deal with this matter, some few months ago. We have had sufficient encouragement to show us that it is quite possible to come to an understanding with the jobbers and just enough to show us the necessity for a Provincial or even a Dominion association.

The jobbers of Toronto have an electrical section in the Board of Trade. I have been in touch with them through their representative and a tentative proposition has been made by them. They propose the adoption of a resale price schedule in dealing with the consumer, with certain restrictions.

They ask the electrical contractors and dealers to submit evidence as to their cost of doing business. Not merely an assertion that it costs us so much percent., but facts and figures to prove it. Over and above this cost a profit would be added and the resale prices to the consumer arrived at in this way. We have accumulated some information, but not sufficient to meet the jobbers on sure ground. We have drawn up a series of questions to be answered by the trade so as to make the information received as uniform and useful as possible.

The jobbers claim, however, that builders or manufacturers having large jobs in view would get prices on the material not only in Toronto but in Hamilton, London, or Montreal, and that therefore they would lose this business for the city if they quoted protective prices. No doubt the jobbers of Hamilton, London and Montreal would tell you the same thing. For this reason they would quote these protective prices only on enquiries under $100 unless they had been advised beforehand, by a contractor or dealer that he was bidding on the enquiry or doing work for the enquirer. That is, as in the case of the oil company I spoke of awhile back. If I notified the jobbers that I had done a job for this oil company, the materials running into $500, they would quote the oil company protective prices when they called up to check our invoice. Their scheme is that we should have one of our members who would receive this information from us, he to communicate it to the secretary for the jobbers, who would in turn communicate it to the other jobbers.

Disadvantages of Scheme

This scheme has many disadvantages. First, it necessitates disclosing our business; second, it would be very slow working; third, the consumer would get one price when the jobber had been notified and another when he had not. You could probably get such an offer in your own towns if you had local organizations, but you can readily see that it is not workable and not good enough if it was. The remedy is to have a provincial organization, to deal with jobbers in all sections at once so that there will be no talk of these enquiries going to other towns and receiving low prices. With a provincial organization we should be able to get a resale agreement without any limit on the size of the sale. This would do away with the necessity of notifying anybody. If we could arrive at this point it should be easy to show the jobbers that they would sell just as much goods of they sold to the trade only, and allowed us to do all the retail business. That would cut down the selling expenses of the jobbers and the number of accounts to handle and increase our sales and profits.

Another point they raise is that certain very large manu-

facturers could go direct to the manufacturers if they quoted retail prices and so they would exclude them from the workings of this agreement. Unfortunately this is true. It means that we must work to the end of refusing to use the goods of manufacturers who sell direct to the consumer, or to jobbers not approved by us, that is, who do not protect us.

Perhaps some of you will say that such a move would be illegal, but it is not under the charter of the Retail Merchants' Association with whom we of Toronto are affiliated. At great expense of time and money they have secured legislation allowing them to make trade agreements and to, in effect, black-list those who do not live up to them by notifying the trade that so and so is an unfair firm who do not keep their obligations.

Profitless Competition

I am convinced that it is action of this kind we need. It should be gained step by step. Every gain will help us to another. It is just such sensible co-working between manufacturer, jobber, agent and retailer that made Germany such a power in the commercial world. Instead of being compelled to waste time and money as we are, in useless and profitless competition, they were encouraged to form trade associations and agreements. To work harmoniously instead of in the cut-throat way that we do. Their energies were devoted to expansion, ours to the extinction of the fellow lower down.

The jobbers want us, in return for their concession, to buy only from legitimate jobbers, who give us this protection and not from these skyrocket travellers of foreign firms who fly through the country disposing of an overstock of some line they want to get rid of. They usually have a low price on some line to get you and try to load you up with something else to make up for it. I say that we should go farther than this. Let the manufacturers sell to the jobbers only. The jobbers to the trade only, and we to the public. We all have our legitimate field and any encroachment on the other fellow in the end is unprofitable.

I firmly believe that all of this can be accomplished, even much easier than the majority of us expect. It only needs united action on our part. We have accomplished a little, we can do it all by organization. It means business, dollars and prosperity to us, and I sincerely trust that my poor effort to this end will arouse every man of you to act at once and firmly resolve to use all your energies to settle this great important matter.

Inspection Rules Governing Electrical Contractors

A Most Helpful Explanation and Discussion

By Mr. H. F. Strickland*

Perhaps you might like to hear a few words in respect to the early history of the inauguration of these rules and regulations, and then we will have a little discussion on matters generally. The electrical fraternity for a long time have felt the need of some legislation to govern electrical work. The Fire Underwriters endeavored to furnish an inspection system without any legislation, but it is almost impossible to make a complete success of anything like that even if you do everything that can be done. Then some time ago a little boy in Gravenhurst happened to be killed by a flexible cord which had been run across temporarily from a fixture and which had short circuited with the transformer outside. The boy was killed while lying in his bed. This so impressed the government as to the danger of electrical apparatus that they decided to pass some legislation, and they are now getting it in shape, and it will not be long before it is completed. It is very hard to know just what legislation to provide until experience has demonstrated its necessity, and it has been necessary each year to amend some of the rules on account of changed conditions. Speaking from what knowledge I have I think by next spring they will have what legislation is required to push this thing pretty vigorously. We think we have the rules advanced at the present time as far as circumstances will permit, and the idea is from time to time to modify and amend them in much the same manner as is done with the National Code. If you think of any changes that would be advisable I will be glad to hear them. Outside of the introduction of the service boxes I do not think there has been any very drastic change in the rules, and no sudden innovation that I know of. I will make notes of any points brought up and they will be carefully considered at the very earliest opportunity.

Eliminate Word "Hydro"

The President: There is one point I might mention here. We think it would be in the interest of the Inspection Department, and everybody else, to have the word "Hydro" cut out of the name of the Inspection Department. People seem to think that the hydro-electric system is responsible for drastic changes which are sometimes made, and they say, Well, we will cut the Hydro Commission out and use some other current. It might be better to make it the "Ontario Electric Commission," or something of that kind.

* Read before tbe Ontario Electrical Contractors' Convention.

Mr. Strickland: Of course I am not in a position to answer what the Commission might do about that, but personally I can see where anybody who is sore at the enforcement of the rules in a way which did not suit him might feel sore at everything that has "Hydro" in it, and I will report the matter to the Commission. Perhaps your association will pass a resolution to that effect and then I can in my report quote the resolution just as it is made.

In answer to the question asked by one of the delegates as to the grounding of cut-out boxes in connection with open wiring, I do not see any necessity to ground them, and I do not know of any rule compelling them to be grounded. I understand some local inspection departments were calling for that regulation, but letters were sent out telling them not to do so.

Grounding with Rubber-covered Wire

Mr. Drury: Is it necessary to use rubber covered wire to ground a conduit, and if so why?

Mr. Strickland: To give you a broad answer regardless of the rules, and I will take them up later, I would say there is no necessity. I will tell you how that comes to be a rule. When we started off we did not want to make a lot of unnecessary changes, and the old National Code called for rubber covered wire on grounding wire, because it said the grounding wire was to be practically the same as the rest of the wiring installation. We have never had any very urgent demand or request made to eliminate that rule and it has not been given very much thought. The difference in the cost between the rubber wire and the weatherproof wire is very trifling, but I am satisfied that if you want the rubber covered wire cut out of the ground wire it will be changed for you. The only object of that rule which I can see, and which I believe was the idea originally, is that if you ground a service pipe in a building or a conduit with

ordinary bare wire or iron wire some fellow comes along and when he sees this thing he does not know what it is for and he pulls it down thinking it is no good, but if he sees a piece of rubber covered wire on an insulator he thinks it is something of use and generally leaves it alone.

Treat Everybody Alike

Mr. Drury: I am not very particular what kind of wiring you put in, only make it so everybody will use the same.

Mr. Strickland: I can assure you we are most anxious to have the rules the same for everybody and have them kept by everybody. There is the possibility of wasting a certain amount of money by putting rubber covered wire in, and if the weatherproofed is put on carefully I think it is alright. The everyday man with the pick-axe does not know whether it is weatherproof or rubber.

Mr. Earle: I would like to ask whether the Department is going to give any stipulated time when any alteration of rules occur. A man might give a price on a contract and the rule might come out the next day.

Will Give Plenty of Notice

Mr. Strickland: I think I can say with a clear conscience that the Commission will give plenty of time. I think there has been ample warning with all these changes. I have thought sometimes there has been too much but perhaps I am a little impatient. As far as I am concerned there will be due notice given of changes in the rules. At the present time I do not see anything in sight in the way of any particular change. It appears to me that conduit work is coming into use more and more. I would like to see everything conduit and then we would have only one rule and that would be conduit wiring.

Mr. Earle: We have had lots of notice of the change, but we did not have any definite date as to when the new rules were going into effect, and in competition with other people we do not want to take any chances. I think the Commission might give us a stipulated time, say two months or one month after a certain date the rule will come into force.

Mr. Strickland: In connection with that matter I think our worthy aldermen are to blame for the enforcing of the rules in Toronto. The Commission made the rules and the city was to enforce them. Now that the Commission are administering the rules themselves you can rest assured that there will be no new regulation launched without due notice.

When Will Laws Be Enforced?

The Secretary: It is not perhaps right for me to ask a question, but when Mr. Strickland was speaking this point struck me. There are rules at present existing in the book and the Commission could tell us they had given us sufficient notice, but these rules have never been enforced. There is one rule requiring sealed service boxes to start alternating motors. I understand they contemplate putting that into effect and if we made any complaint about not getting sufficient notice the Commission would be quite within their rights in telling us they had been in the book for a year. We want notice that the rule that is in effect will be enforced.

Mr. Strickland: That question of starting motors is a big one. There is no question about it that the old methods of putting in switches to start induction motors and the method of placing the switches is wrong. I do not think there is anybody on the floor of this house would for a minute try to justify or defend the old system of putting switches in manufacturing establishments right under the nose of unskilled operators and where they can be short circuited and everything else. We will certainly send out a bulletin. At the present time the rule on starting motors calls for a double throw switch up to a certain size. Some rules would require that switches be enclosed, but my idea now, which I think will meet with the approval of the Commission, is under the heading of motors to put another rule which will combine the protection or the covering in with the new box itself so that there will be only one rule. Before that rule comes out it will be well advertised. We will not print that rule in the book until we have heard from all the authoritative bodies dealing with electrical work. (Applause). At the present time I might say in some of the larger inspection districts we are urging the adoption of those more improved types of motor starting devices.

The tendency now is to get these small motors started with some form of iron-clad switch so that the employees cannot go and put their hands on it and where the device cannot blow out and set fire to anything, will be easily fused and will not cost too much money.

The trouble is, people do not want to spend the money for up-to-date equipment. They do not want to spend $2 or $3 on a switch. I think these electrical rules should be strict and enforced pretty strictly with a certain amount of horse sense coupled with it. Of course, after anything happens they would have been willing to spend thousands of dollars, but before the fact they are not willing to spend one thousand cents.

Make the Rules Definite

Delegate: There is one point I would like to speak about regarding the rules. Some two or three years ago it was discussed and decided that the rules would be so definite there would not be much room for argument, but apparently there is still too much left to the discretion of the inspector, and that makes it rather unfair for the average contractor in figuring because he is not sure what the other fellow can get out of. If there is a loophole at all there is always somebody looking for it, and the average man probably does not know it. In respect to conduits I understand the idea was that the rule should be so definite there would be no way of misunderstanding it. If you get over a half inch pipe you can put any number of wires in it, although that wasn't intended.

According to one reading of the book in a three-quarter inch pipe you can put in eight wires, and I don't know whether you should do it or not. I think the rules should be made as definite as possible.

Mr. Strickland: In making the rules it is a very very difficult matter, and in fact I do not believe it is possible, to make electric wiring rules so absolutely positive in every detail, because then you are getting it down to a specification. You might just as well expect the city to make a by-law for building which would furnish the contractor with every detail for that building. All the wiring regulations I think can do is to provide the minimum requirements, the same as with plumbing or anything else. I do not think anybody starting out to build a house would say to his plumber I want you to fit my house up with plumbing according to the city by-law. The contractor would say what kind of basin do you want? Oh, never mind, just put in the plumbing according to the city by-law. The architects, when dealing with wiring, have very largely said to their contractor, fit up that building according to the wiring rules. Well, they say, what kind of wire do you want, what kind of conduit? Oh, just wire it according to the Underwriters' rules, that is all. I have seen some specifications on wiring; some have been drawn to our attention in the Electrical News. I think the day should come as quickly as possible, and I am in favor of helping it all I can, that every wiring job of any consequence should have a proper specification, and if the architect cannot write one himself let him get in somebody who can. I remember writing a specification for an architect about twenty years ago, and that architect used that specification in his office for years and years, and I do not know but what he is using it yet, not taking into

account the advancement in all sorts of electrical appliances.

There are times when it is really necessary to permit more than the orthodox number of wires in the pipes. I believe there are a great many contractors who have come across conditions and emergencies where to allow a few more wires than the orthodox number would be good practice and it would be almost better than putting in more pipes and possibly spoiling the look of some place in order to comply with the exact meaning of the rule. I do not believe that that rule can ever be made absolutely positive. The best that can be done is to prescribe a safe average of the number of wires in the pipe, limiting them in this way, that they must not be crowded in the pipe if it can be avoided or where it is not necessary. It is just a question of getting a good rule that will take care of it and we will take that into consideration.

Arbitrary Wording Might Work Hardship

When starting to make a rule there are a great many questions come up, and you find if you make a rule absolutely positive something may happen and it is not wise to make it in that way. If we make a law and say that such a thing must be done in such a way it gives the inspector no option, although under certain conditions a better way might present itself. The inspector would be governed entirely by the text of that rule, although it might be that the other was the better way. Thinking that such conditions might arise this clause was introduced into the rules, "In order to get over such a difficulty in the interpretation of installation rules all arbitrary figures or requirements must, where there can be no possible practical objection, be rigidly adhered to, but in any unforeseen case and where it is entirely impossible or manifestly unnecessary to thus rigidly adhere to such arbitrary figures or requirements the question must be settled by the spirit of the rule, and the inspector having jurisdiction is allowed to make such deviation from the rule as circumstances will permit."

That clause I know has been the means of saving a great deal of trouble all down the line. There is hardly an inspector in any district in Ontario that has not had occasion to use it. Ordinarily the rule is alright, but in some particular case the construction of the building or something may make it a better proposition to change it, and if that rule was not in the book the inspector would have to adhere strictly to the wording.

Appliances Used on Sockets

Mr. Windeler: With regard to appliances, do you not think there is some way of making a law to prohibit power distributing organizations from selling an appliance and sticking it on a socket. When you are wiring a house you want a special circuit for an iron, but you go down to the T. E. L. or the Hydro and they say just buy this iron and stick it on your wire.

Mr. Strickland: I do not want to say anything unkind, but I think the best thing to do is for every man in the electrical business to stop doing it, first of all. Let no man in the electrical business put anything on his own socket. I know nobody here would do it, but I have seen them. (Laughter). But joking apart, I quite sympathize with Mr. Windeler. I remember attending a convention in New York and one of the speakers said that the people in the electrical business were amongst the worst offenders, and he instanced a case where he had gone into an electrical shop and picked up a box with a device which used over 600 watts, and in that box was a picture of a beautiful girl sticking this thing onto a socket, and the printing said you do not need any extra wiring, it is not necessary to wire, stick this onto your socket. That was put on there by the people manufacturing that device, and those are the people we wanted to get after, very often. There are lots of things we are not supposed to do but which are done just the same, and the point is to enforce the law. If you have a drastic law with a punishment of penal servitude, then you have to have a lot of inspectors to find out who is breaking the laws. The only thing I think you can do with that is to have the co-operation of the dealers, and possibly advertising the use of conduit sockets in connection with this device. I think there might be something done along that line, the introduction of a higher grade of socket. I am very much in favor of having high grade sockets.

Mr. Windeler: Supposing you have 600 watts on the circuit as it is and somebody puts an iron on that takes another 600 watts that is going to overload the wire, and the Code says we can only put on six amperes.

Difficult Matter to Handle

Mr. Strickland: That is a thing that has not been successfully handled anywhere yet, in any civilized country. They might have done so in Germany, but in Germany you are not allowed to sing unless you shut the window. The difficulty is, regarding this putting devices on flexible fixtures, to catch the fellow. Our inspectors have stopped it where they have had a chance. There are rules now against it and it is a matter of breaking the law. I think it is very distressing and it should not be done.

Mr. Drury: If I am called in by a man to put in a couple of extra plugs, and when the inspector comes in he finds the other part of the installation was put in years ago and is not according to the rules, what is the use of making me do my work up to standard and leaving the rest out of order?

Mr. Strickland: The only method you can adopt with old wiring is the same as with any other old ordinance. The city does not require a man to take out an out-of-date closet or basin unless there is something wrong with it in a sanitary way. If an inspector goes into a house or building and sees something that is really dangerous the owner's attention will be drawn to it. A question come up some time ago where a new inspection was called for where the man was perhaps only putting in one outlet. The inspector went up there and while there inspected all the rest of the house and then wrote the man that he had to rewire that place or had to do a whole lot of work before he would give him a certificate on the new work. Now, that is the wrong way of doing it, but I will tell you what we are going to do just as quick as it can be done. It takes time to get these things working, but I think the Commission will approve of this. We are going to take the winter seasons when new work is not pushing us to make a systematic report on all installations. Here is something I think you will appreciate. You go to work and put an outlet in your house and you have the inspector up and he says that new outlet is alright but I want you to re-wire the rest of this place, I don't like this and that. The fellow next door to you puts an outlet in perhaps himself, or his son does it, or some other clever person in the family, and he doesn't say anything, and he comes over to you and says "you don't want to trouble the inspector for if he comes up and sees my house he will make me build a new house." You naturally feel sore, but if the inspector comes along your street a month or so hence at an ordinary time and you get a report that they are making an inspection of that whole district, it is alright. Everybody gets the same thing. It becomes a systematic method of inspection. I do not think the two should be mixed up. I do not think the time of making an inspection of a new job is the time for making the other inspection. The tendency is to say "well, I won't get the wiring inspector in." I know one man whose father had his house wired and it cost him $90 to change it and he thought the contractor who did his work and the inspector put up a job on the old man, and

he pretty nearly caused trouble all down the line. With this new plan the question of remodelling old wiring will be taken up systematically. There is a lot of it being eliminated anyway.

Hard on the Consumer

Mr. Nealon: I think it sometimes makes it very unfair to a person who has just moved into a new house where they have no gas lighting purposes whatever, and everything is passed satisfactorily with the exception of a chain pull socket in the kitchen hanging from the centre with a straight electric outlet, no danger of any kind, and they are held up for three days perhaps simply because that chain pole socket wasn't insulated properly. I think a little thing like that should not hold up the whole job. If a little thing is to be changed they should get into communication with the contractor who is putting in the fixtures and give the man current in the meantime. I do not think it is right to hold the inspector for two or three days before he gets after it. I know of cases where it has been two or three days before it is put in his hands and it is very unfair to the people who want to use the current. If the inspector notified the contractor that that thing is defective he might then let the permit go through, but the contractor must be honest and fair with his customer. The inspectors, however, might use a little better judgment.

Inspectors Using Good Judgment

Mr. Strickland: I quite appreciate the speaker's contention, but there are troubles on both sides. I may say, speaking for Toronto now, that I do not think you will find any applications in the Toronto office held up for this reason. (Applause). We have originated a system now which I do not thing is excelled anywhere on this continent or any other continent, and if anybody will come down there we will be glad to show him, and if they can tell us anything better we will be tickled to death. We have spent a lot of time and thought in getting this system of inspection as simple as possible. We have cut out a lot of routine work and a lot of unnecessary labor. The way it is done now is this, that the man puts his application in and it states on that application when that job is ready for inspection. The filing clerk is responsible for seeing that that application states when it is going to be ready for inspection, and on the morning stated that application is on the inspector's desk, and I am very badly mistaken if it is not attended to on that day. The inspector has got to keep that application in his desk and keep it entered up and recorded until it is disposed of, and when he gets through with it the proper clerk in the office issues the certificate. If anything turns up in the inspection that the inspector does not like to take the responsibility for he looks to somebody above him by whom it will be decided.

I am quite enthusiastic with out new system in our Toronto office and we are getting it introduced in our outside offices. We have inspection offices from Fort William to Ottawa and in practically every important centre in Ontario to correspond with and keep in touch with, so it is a pretty big proposition. I think it is the biggest inspection district in the world.

I made the remark that there was trouble on both sides. The inspectors have their troubles, I can assure you. Lots of the owners are just as bad as the wire men. A man will come in and say "I have got my job all finished but the inspector says there is one little thing here or there that needs fixing and I want to get my current on this afternoon." We are always glad to help anybody out if we can, and on his assurance that he will have it fixed by 12 o'clock next day we say all right. He is a business man and we take his word for it, but when we go back in a week we find it has not been done.

Two Sides to the Argument

I do not believe you should enforce those rules so drastically that no current should ever be turned on or no certificate ever issued until every part of the job is absolutely finished. There are times when there is something you cannot get and at the same time the people must have light. It is almost dangerous sometimes to let them go without it. Instructions are given now, and the inspectors are doing their best to live up to it, to have the jobs finished as far as practicable, but if anybody comes in with a bona fide story that he must have the current on he will get it. We manage the outside districts pretty well in eliminating that temporary business, and I think it can be eliminated if the inspectors handle it carefully. I think the inspector should investigate where temporary permits are asked to find out if they really do need it. People come in with great tales of woe and when we investigate we find there isn't a motor in the place possibly. One case I investigated the man was waiting to get the service in by the Toronto Electric Light Company who were furnishing the power. He hadn't his motors in and he couldn't get current, and yet he must have a temporary permit. There are lots of these things when investigated turn out to be nothing at all. I would like to ask some of these gentlemen from the outside towns who are subject to the Hydro inspection if they find things working out satisfactorily.

Very Amicable Relations

Mr. Zannoth (Windsor): In our town we have found the inspector very accommodating, and I think the co-operation between him and the electrical contractors cannot very well be beaten. There was a meeting called right at the outset and rules drawn up, and the inspector made the different points very clear to the various contractors, and everything is working very satisfactorily.

I would like to ask about one thing. We do most of the electrical fixture business, and there is one part of the Code that works a little hardship on us, and that is that part which makes us paint the joints on the fixtures. I do not quite see the logic of it. We do a great deal of high class work and a great deal of work on tapestry walls, and so forth, and it is a nuisance. Our men have to paint the joints and let the fixtures hang down the wall, which sometimes soils the wall, and we have had to stand the damage. Now, that joint is painted and the fixture is put up on the wall and the inspector comes along and takes the fixture off and opens the joint. I cannot see the logic of painting it and then having it open.

Mr. Strickland: I am quite prepared to admit that is a point. I may say I do not like the whole business of fixture joints, and I think it is about time there was something better. I quite agree with the last speaker. I had a little device shown me a few months ago that I thought was pretty good. I do not remember the name of it but I will tell you what the article was. There was a fibre shell hollow, and down near the bottom it was solid. There was a cap fitted on that, making the whole thing shaped like an acorn. There were little brass connections just like you see in a receptacle or anything else with four holes through the base, the wires coming down from the ceiling through these holes and fastened onto these screws, and the fixture cords came in this same way. The whole thing was only about three-quarters of an inch long, and all you had to do was screw it apart and there were your wires. We tested it and we found you could melt these terminals and it didn't hurt a particle. I thought it was a good idea. The cost was estimated at a very small amount, something around a cent or two.

A Useful Device

Mr. Nealon: I would say the man that made that used good judgment and it would be a boon to the electrical trade.

I think the Hydro Commission ought to take it up and enforce it and do away with this nuisance. That thing would simplify the whole business, and if it was put into the Rule Book and enforced it would be a good thing.

Mr. Strickland: We will look into that.

In answer to a question if the rules stipulated an iron outlet box: There is no positive rule on that point, it is only a suggestion. There are some places in the United States where they have it in their local ordinances, but not here. I think the idea is good. When you take a lot of care to separate the wires and so on it seems to me the outlet which is one of the most crucial parts of the whole job should not be jammed up and twisted together. I think every outlet ought to have a box.

Pleased with Inspection

Mr. Soulles (Oshawa): Speaking as one from out of town I want to say that we are very well pleased with the inspection so far. Our inspector has done everything in his power to make it as reasonable to us as possible. If any question comes up he writes for a decision from the Commission, which has always come very promptly and clearly. We hope that any amendments that are made will be to our mutual benefit.

Mr. Strickland: It is most gratifying to hear that statement, and I can assure you we are trying to make it that way. I want to say in conclusion that I know that the Commission are desirous of having these rules enforced, and I can assure you your humble servant here is most anxious to do so. I want to please the Commission, of course, but I also want to try and make the service satisfactory to the people I am dealing with. Any suggestions that anybody can make at any time will always be carefully considered. You can rest assured we are trying to make this a good inspection system. We want to make it so that people will come over here to see our system instead of us going to them.

Electricity at the Exhibition

Electrical exhibits at the Canadian National Exhibition do not appear to have suffered from the adverse conditions at present existing in Canada. It is probably safe to say that on the average our electrical display was more attractive than ever, though possibly not what it would have been under more favorable circumstances; nor, do we think as much prominence is given to electricity in the Big Fair as the importance of the industry justifies. The following exhibits, however, were occupying prominent places throughout the exhibition dates and attracted a very gratifying share of the visitors' attention:—

Clements Manufacturing Company, Toronto—Demonstrating the Cadillac and Big Ben Vacuum Cleaners.

Invincible Renovator Manufacturing Company, Toronto—Electric Vacuum Cleaners.

Dominion Sales Company, Limited, Toronto—Electro-Vac, a combined sweeper and electric vacuum cleaner.

1900 Washer Company, Toronto—Electric Washing Machine.

Detroit Fuse & Manufacturing Company, Detroit and Walkerville—A very elaborate display of safety service boxes and fuses.

Jas. Morrison Brass Manufacturing Company, Limited, Toronto—Electric Lighting Fixtures.

Tallman Brass & Metal, Hamilton—A very pleasing exhibit of electric fixtures, showing many new designs which reflect very favorably upon the facilities of the company.

Norton Telephone Company, Toronto—Intercommunicating telephones for apartment houses, factories, etc.

Northern Electric Company, Limited, Toronto—A complete line of telephones and electrical supplies.

W. H. Banfield & Sons, Toronto—Electric fixture parts and chains.

Jefferson Glass Company, Toronto—Many pleasing designs in illuminating glassware, featuring Moonstone and Lumo.

National Electric Heating Company, Limited, Toronto—Electric heating devices such as Toasters, Irons, Hot Plates, Air Heaters and a complete line of electric ranges.

Interstate Electric Novelty Company, Toronto—Flash lights, lamps and batteries, featuring the Gold Medal won at Panama Pacific Exposition with a percentage of 100 among 22 competitors.

Canadian Independent Telephone Company, Limited, Toronto—Telephones and accessories, featuring the Prestophone; also switchboards.

Stromberg-Carlson Telephone Manufacturing Company, Toronto—Telephones and supplies.

Chas. A. Branston Company, Toronto—With a very instructive demonstration of the Branston Violet Ray High-Frequency Generator.

McDonald & Willson, Limited, Toronto—Electric Lighting Fixtures. Cadillac Vacuum Cleaners and Dumore Sewing Machine Motors.

Renfrew Electric Manufacturing Company, Limited, Renfrew—Electric Irons, Toasters, Heaters and Heating Appliances.

R. A. Lister & Company, Limited, Toronto—Automatic Electric Lighting sets for isolated locations.

Jones & Moore, Limited, Toronto—Agents for "Century" Motors, showing electric motors from 1 to 30 h.p., a.c. and d.c.

Jones & Glassco, Montreal—Exhibiting the practical uses of Renold Silent Driving Chains.

Moffat Stove Company, Limited, Weston—A complete line of Electric Stoves and Ranges.

British Aluminium Company, Limited, Toronto—Aluminium wires and cables, tubes, sheets, ingots, bus-bars, etc.

Canadian Carbon Company, Toronto—Showing a complete line of flash lights, flash light lamps and batteries; also their famous X-cell Dry Batteries.

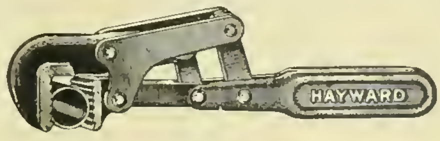
Cummer-Dowswell, Limited, Hamilton—A very attractive line of electric washing machines.

A. H. Winter Joyner, Limited, Toronto—Showing Weston Indicating Instruments and Pemco Street Lighting Fixtures.

Canadian Ever-Ready Works—With a very pleasing display of the famous Ever-Ready Flash Lights, Hand Lanterns, Batteries, etc.

Automatic Pipe Wrench

The pipe wrench shown herewith is manufactured by the Hayward Wrench Co., St. Louis, Mo., and is so linked that no adjustments are required for different sizes of pipes, and the greater the force with which the operator presses on the handle the greater is the pressure tending to grip the pipe. The wrench has a quick-release and ratchet move-



ment and is strong and durable. It is of high-carbon drop-forged steel and is made in three sizes—one 7 in. long, another 11 in. long and another 14 in. long, with jaw openings respectively 1.15 in., 1.375 in. and 1.875 in. The weights are 11 oz., 1 lb. 14 oz. and 3 lb. 6 oz. respectively

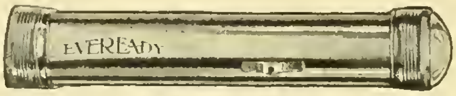
Motor Starting Devices

The intention of the Hydro-Electric Power Commission Regulations has been to eliminate, as far as possible, all danger from shock. The solving of the problem has been somewhat delayed, owing to lack of suitable motor starting devices which would successfully be the means of relieving these conditions. Heretofore, the only solution of the difficulty in connection with small motors was the use of ordinary double throw knife-blade switches enclosed in steel boxes. These were only a protection to a certain degree and once the operator was more or less familiar with what he was doing he was just as liable to receive shocks, and even fatal ones, as would be the case if the switch was completely open; in fact, in some cases even more so, for instance, a triple blade 550-volt switch enclosed in a steel cabinet in connection with a conduit system would require great care in handling.

Now that there are fool-proof and shock-proof starting devices on the market, the Commission inspectors are being instructed to call for such devices and the old style open blade switches under such conditions will not be approved. Samples of up-to-date starting devices are to be seen at the Head Office of the Commission's Inspection Department in Toronto. Such devices are not, however, compulsory on low voltages, that is to say, 110-volt circuits where ordinary precautions are observed, but in the placing of these switches throughout manufacturing establishments where unskilled persons are able to handle them inadvertently, the Inspection Department will insist upon proper safety guards.

Flashlights for the Tool Box

The Canadian Ever Ready Works, 86-90 Chestnut Street, Toronto, are offering a line of handsome nickel plated solid metal case tubular flashlights for the electrician, plumber, the steamfitter, and the motorist. These lights are water and oil proof and cannot be short-circuited by contact with tools, etc. They are made in all standard sizes in



straight tubular types, also with large parabolic reflector for general outdoor use. They are equipped with the famous Ever Ready "Tungsten" guaranteed battery and the Ever Ready Mazda lamp. The case, battery, and lamp are "made for each other" thus insuring the maximum of efficiency. The Canadian Ever Ready Works have been manufacturing in Toronto since July 1914, and state that in spite of war conditions, their business has shown a most gratifying growth.

Renfrew 6-Slice Toaster

One of the features of the Renfrew Electric Mfg. Co.'s exhibit at the big fair was a six slice toaster suitable for hotels, restaurants, cafes, etc. Controlled by 3 switches either 2, 4 or 6 slices can be toasted at once at will.

An Interesting Booklet

The Flexible Conduit Co., Guelph, Ont., are distributing an interesting booklet covering the history of the development of electric lighting practices and electric lamps. It is an interesting compilation.

In Better Quarters

The Masco Company, Limited, jobbers of standard electrical goods, have sent out a removal notice announcing that after September 1 they will be found at their new premises, 91-93 Queen Street East. Better quarters at this number will mean improved facilities for serving their customers.

Trade Inquiries

922—**Machinery.**—A Cape Town firm of dealers with organization covering every district in Western Province is prepared to purchase, if suitable, or handle as agency, agricultural, dairy, irrigation or lighting machinery and prepared to handle on commission any article suitable for farm or farm house. On some lines would purchase outright.

973—**Steel tramway rails, wire.**—A London firm is open to receive quotations on steel tramway rails, also to purchase fish-plates, and to receive quotations for copper trolley wire and bonds.

964—**Meters and phonographs.**—A Swiss firm desires the addresses of Canadian manufacturers of electric, water and gas meters, and also of phonographs.

New Books

Arithmetic of Alternating Currents,—by E. H. Crapper, M. I. E. E.; Whittaker & Co., London and New York, publishers; price 25s. 6d. This volume is intended to serve as a companion to text books on the theory of alternating and polyphase currents and has been prepared because the author believes there is a demand for a book providing graduated exercises arranged so as to bring into prominence the fundamental quantitative relationships existing between the various factors of the alternating current circuit. Suitable exercises are given and numerous illustrations to assist in the mathematical presentation of the subject. 208 pages including exercises. Size about 5 ins. x 7 ins.

Electric Light and Motor Wiring—By George J. Kirchgasser, Electroforce Publishing Company, Milwaukee, Wis., publishers. This is a vest-pocket edition describing in detail the different systems of lighting and wiring, including the requirements of the National Electrical Code. Well illustrated.

Tramway Track Construction and Maintenance,—by R. Bickerstaffe Holt, Highways and Permanent Way Engineer, City of Leeds, M. I. E. E., etc.; Tramway and Railway World, London, publishers; price 10 s. 6d. The following chapters indicate the interesting treatment of the subject matter in this book: Concrete Foundations; Concrete Materials; Repairs to Concrete Foundations; Track Design; Rail Laying; Joints, Fish Plates, Bolts and Nuts; Joint Welding; Rail Wear; Composition and Manufacture of Tramway Rails and Rail Wear; Corrosion of Tramway Rails; Track Paving; Reconstruction; Surface Drainage and Rail Maintenance; Special Trackwork. Size about 6 ins. x 10 ins.; 250 pages; printed in regular Tramway and Railway World style and splendidly illustrated.

Trade Publications

Window Lighting—Booklet B-3351, issued by the Canadian General Electric Company, entitled "How to Put Daylight Into Your Show Window," describing the lamps and reflectors manufactured by this company for window lighting purposes.

Outdoor Sub-Stations.—The Delta-Star Electric Company, Chicago, are distributing descriptive leaflet No. 740, describing the construction of high tension outdoor wooden pole sub-stations. Ten typical installations are shown, and will be of interest to those concerned in high tension transmission.

Several descriptions of new apparatus are unavoidably held over until Oct. 1 to allow more space for the Convention proceedings.

Current News and Notes

Brantford, Ont.

The result of six months' operation of the Grand Valley and Brantford Street Railway systems by the city of Brantford, has resulted in a net loss of $3,438.85. The Commissioners state in their half-yearly report that they are hopeful that during the next half-yearly period the property may come to be on a self-sustaining basis.

Calgary, Alta.

The electrical interests of the city of Calgary held a picnic to Bowness Park on August 28th.

Cobalt, Ont.

The Northern Canada Power Company are reported to have made a decision to increase their plant in the Porcupine district at a cost of approximately $1,000,000.

Dutton, Ont.

Niagara power was officially turned on on the evening of August 30th by Sir Adam Beck, in Dutton, Ont.

Formosa, Ont.

The power line connecting Formosa with Walkerton is reported almost complete. When the power is formally turned on a celebration will be held in Formosa, including an exhibition of the uses to which electric power may be put in the home and on the farm.

Granton, Ont.

The town council is planning to submit a by-law in the near future asking authority to expend $5,000 on an electrical distributing system which will connect up with Niagara power.

Harriston, Ont.

The Harriston Town Council has approved a contract with the Hydro Commission providing for the supply of 200 h.p. at $46.60 per h.p. It is stated that Harriston will be equipped with power by the end of the present year.

Hamilton, Ont.

Mr. John Knox, treasurer of the Dominion Power and Transmission Company, and president of the Western Canada Electric Company, one of the subsidiaries of the Dominion Power and Transmission Company, died recently at his home in Hamilton. Mr. Knox was a native of Kilwinning, Ayrshire, Scotland.

Kingston, Ont.

The Kingston Standard has been writing editorials and quoting figures purporting to show that the rates in Kingston are now considerably in excess of what they were before the Hydro Commission of Ontario had the fixing of rates. In one case an increase of 300 per cent. is claimed, and the insinuation is openly made that the price of power in Kingston is higher than in any other city in Canada.

Mimico, Ont.

The Hydro Electric Power Commission of Mimico and New Toronto have appointed Mr. A. Cook, of Weston, superintendent of the distributing system. It has been decided to extend the line along Church Street if sufficient customers can be found to make it a paying proposition.

Montreal, Que.

Mr. Geo. Cahoon, Jr., vice-president of the Laurentide Company, Limited, is quoted as stating that they expected to start up the first of the units in their new plant about November 1, two more about November 15, and the remaining three by January 1 of next year. The final development of this plant is placed by Mr. Cahoon at 125,000 h.p.

Latest reports show that the Shawinigan Water & Power Company's earnings are considerably in excess of corresponding month a year ago. The same is true of the Montreal Light, Heat and Power Company.

The Eugene F. Phillips Electrical Works, Limited, Montreal, have secured a contract from the Toronto Hydro-electric Commission for the supply and installation of 7,000 feet of 000 B&S, 13,200 v., 3 conductor, paper insulated, lead covered cable. The Montreal Light, Heat and Power Company have also placed an order with the Eugene F. Phillips Company for a quantity of 13,200 v., 3 phase, paper insulated lead covered cable.

New Glasgow, N.S.

The electricians of New Glasgow have formed a union of electrical workers and will apply for a charter.

Niagara Falls, Ont.

Mr. Sydney Burrowes, manager of the Niagara Falls Electric Company, has received a message advising him of the loss of his brother Guy, who was a member of the Royal Munster Fusiliers, engaged in the Dardanelles.

Outremont, P.Q.

The city of Outremont, P. Q., have passed without opposition from the proprietors, a by-law authorizing the city to negotiate and take over the public and private lighting system of the Montreal Light, Heat and Power Company. The by-law also gives the city power to establish a plant and distribution system, the cost and maintenance of the public service being chargeable to the proprietors of real estate bordering on the streets lighted. Dr. L. A. Herdt, the consulting electrical engineer of the city, is reporting on the entire scheme.

Petrolia, Ont.

It is understood that the final offer of the Petrolia Utilities Company to sell out to the town was not accepted and that a duplicate distributing system will be installed.

Red Deer, Alta.

Negotiations are still proceeding between the city council and the Western General Electric Company for the purchase of the plant of the latter company by the city, and its operation as a municipal enterprise. There is apparently still a considerable difference between the value placed on this plant by the two parties, the company contending that the city is unwilling to make due allowance for the value of the franchise which has still several years to run.

Strathroy, Ont.

The Hydro-electric System of Strathroy shows a net profit of $263 for the first six months' operation. This is looked upon by the citizens of Strathroy as highly satisfactory.

Sackville, N.S.

The Eastern Electric Light & Power Company recently discontinued their day service in the town of Sackville, and the matter was brought by the town before the Public Utilities Commission of New Brunswick. Mr. G. O. D. Otty, Chairman of the Commission, stated that they would not ask the company to continue the day service until a careful investigation of conditions had been made. This was the result of a statement by the company that they were losing money on the proposition.

Corporation Jobs as Fellowships in N. Y. U. Commercial Course

As part of the instructional work offered by the School of Commerce of New York University, "business fellowships" with a number of large industrial corporations are offered students who wish to combine practical experience with theoretical instruction in business subjects. Fifteen of these business fellowships are now available, the men to fill them being chosen, on their basis of individual adaptability, by Prof. Jeremiah W. Jenks, head of the Graduate School, and by the chiefs of the employing organizations. The corporations co-operating in the plan include the American Telephone & Telegraph Company, the Western Electric Company and the National City Bank of New York.

Lighting Schedule October, 1915

Courtesy of the National Carbon Company Cleveland

Date	Light	Date	Extinguish	No. of Hours
Oct. 1	6 10	Oct. 2	0 30	6 20
2	6 10	3	1 30	7 20
3	6 10	4	2 40	8 30
4	6 10	5	3 40	9 30
5	6 00	6	4 50	10 50
6	6 00	7	5 20	11 20
7	6 00	8	5 20	11 20
8	6 00	9	5 20	11 20
9	6 00	10	5 20	11 20
10	6 00	11	5 20	11 20
11	5 50	12	5 30	11 40
12	5 50	13	5 30	11 40
13	5 50	14	5 30	11 40
14	5 50	15	5 30	11 40
15	9 40	16	5 30	7 50
16	11 00	17	5 30	6 30
18	0 10	18	5 30	5 20
19	1 20	19	5 30	4 10
20	2 20	20	5 30	3 10
21	3 20	21	5 30	2 10
22	No Light	22	No Light	
23	No Light	23	No Light	
24	No Light	24	No Light	
25	5 30	25	7 50	2 20
26	5 30	26	8 30	3 00
27	5 30	27	9 20	3 50
28	5 30	28	10 20	4 50
29	5 30	29	11 20	5 50
30	5 30	31	0 20	6 50
31	5 30	Nov. 1	1 30	8 00

Total Hours 209.40

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Vol. 24 Toronto, October 1, 1915 No. 19

Electricity Alone Cheaper

Thirty-six years ago this month Thomas Edison introduced to the world his first commercial incandescent lamp. Its (in)efficiency was 7 watts per candle. The progress of thirty-six years is represented by a lamp which consumes only one-half watt per candle—fourteen times as efficient.

Keeping pace, too, with this increase in lamp efficiency, we have had no less remarkable improvements in generating and transmitting equipments and methods. So that, as a result, the cost to the consumer of his kilowatts has been reduced almost, if not quite, in the same ratio as the consumption per candle-power. This is a side of electric light and power we too frequently lose sight of. The actual ratio of the cost of lighting to-day as compared with thirty-six years ago is not, then, 1 to 14, but 1 to 14^2, i.e., 1 to 196. Further than this, the perfection of the modern reflector, the scientific placing of the units and so on, have again perhaps halved the cost of lighting so that the home, the factory and the office to-day pay for their light only somewhere from ½ to ¼ of one per cent. of what it cost the previous generation.

Yet it is difficult to get the public to realize this fact—difficult even to get electrical men to do so—that for value received, electric light and power is one of the cheapest, if not the cheapest, commodities we purchase. Practically everything else on the face of the earth costs more than it used to. What item of everyday expense does not? Electricity alone costs less—hundreds of times less—bringing it within the reach of all.

It is interesting to follow the gradual evolution of the modern incandescent. In 1879, as noted above, the efficiency was 7 watts per candle; in 1880 a carbonized bamboo filament increased this to 5.8; in 1881 to 4.8 and, shortly after, the cellulose filament lamp gave us a candle-power for 3.1 watts. The highest state of the carbon lamp was reached in the metallized filament produced by heating the carbon to a high furnace temperature; this gave us 2.5 watts per candle.

No further immediate commercial advantage, over the metallized carbon filament, was gained until 1906, though osmium, tantalum and other metals were tried, with slightly increased efficiencies. Since 1906 the progress has been one of steady improvement in the tungsten lamp, which, in the latest forms, surrounded by some inert gas such as nitrogen or neon, shows an efficiency as high at least as two candle-power per watt; this is in the largest sizes only. Smaller sizes of nitrogen filled lamp are now being manufactured down to 60 watts, but naturally the efficiency is lower—about .85 watts per candle. So far these smaller sizes are chiefly of the series burning type and so are most suitable for public buildings, stores or street lighting.

Arc lamps, for the time being, at least, are taking second place in interest to the incandescent. It is still true that the incandescent cannot compete in efficiency with the arc, but what it lacks in this way it more than makes up in its greater adaptability to the varied requirements of most lighting systems. Under certain conditions, however, the arc lamp is still holding its place and apparently will continue to do so.

Steady progress in the way of "refinements" has been made along various lines of illumination. Street lighting by clusters is gradually losing its glamour and being replaced by the more scientifically correct, as well as more attractive, in the opinion of many students of this subject, single unit standard. Store owners, little by little, are appreciating the value of better illumination and especially in window lighting distinct headway is being made; this is due, in part, also to the greater attention paid by the manufacturers to proper reflectors for this purpose. Sign lighting, some of it exceedingly attractive, is now a feature of the main streets of every progressive city and town.

In one conspicuous instance—lighting in the home—there is little sign of advance. We make our stores bright to make them attractive; the same with our streets. But we follow an entirely different policy in our own homes. There we seem to believe entirely in "spot" light effects—where the spots, generally over-bright, only emphasize the darkness of the rest of the house. We all speak with more or less dread of the short winter days and fail to realize, or refuse to realize, that a simple turn of two or three switches and the expenditure of a few cents will dispel that dreadful darkness. Only the habit of ages prevents us. One dollar a month extra at a 3-cent rate would give us 500 candle-power more for two hours every night—think of it—make our day two hours longer at a cost of 3 cents per day. But just because our forbears were cave-dwellers—so are we.

Electricity in the Home

Electricity in the home is a luxury without being an extravagance. The city of Toronto has, we believe, the cheapest gas rate on the continent where manufactured gas is used. Yet electric cooking in Toronto competes on a dollars and cents basis with gas at 70 cents. Here are a few examples of monthly bills taken from among the accounts of the Toronto Electric Light Company:

(a) An eight-roomed residence, four in the family, in which a range, iron and toaster are in use. The monthly bill averages $3.06 at a net rate of 2.5c. per kilowatt hour.

(b) An eight-roomed residence, six in the family, in which a range, 2 toasters, an iron and a coffee percolator

are in use. Average monthly bill of $4.47 at a net rate of 1.98c. per kilowatt hour.

(c) An eight-roomed residence, five persons in the family, using a range, toaster, fan and radiator, all operated electrically. Average monthly bill of $3.96 at a net rate of 2.11c. per kilowatt hour.

(d) Four-roomed apartment, five persons in the family, using a range, a small hot plate and an electric iron. Average monthly bill of $1.93 at a net rate of 2.14c. per kilowatt hour.

(e) An eight-roomed residence; eight people in the family, employing a vacuum cleaner, washing machine, coffee percolator, toaster, iron, electric automobile and electric range. An average monthly bill of $8.17 at a net rate of 1.64c. per kilowatt hour.

(f) A nine-roomed residence, six people in the family, employing a range, two irons, small heater and coffee percolator. An average monthly bill of $4.86 at a net rate of 2c. per kilowatt hour.

(g) A seven-roomed residence, five people in the family, employing a range, toaster, iron and two fans. An average monthly bill of $3.56 at a net rate of 2.06c. per kilowatt hour.

(h) A nine-roomed house, four persons in family, using range, toaster, iron and sweeper, $3.28 or 2.6c. per kilowatt hour.

(i) Nine-roomed house, five persons in family, range, toaster, iron, sweeper, percolator, $3.78 or 2.4c. per kilowatt hour.

Now it cannot be argued, of course, that these figures are less than the average gas bill in Toronto. They probably are higher. The man who buys an electric range for his home, however, is not (yet) the average man. He is a type rather who believes in efficiency—the most favorable working conditions—in his home as in his office or factory. He is not the ultra economical type. He likes plenty of light, plenty of toast, coffee and good wholesome meals. He doesn't mind the size of the bill so long as he gets value. That is the type of man represented in the figures above. His bills for gas, if he used gas, would be quite as large—only he wouldn't be getting the service.

Educating the Public

By W. G. H. Cam

In a scientific journal some few years ago there appeared the following paragraph: "Great progress has been made in educating the general public to a higher standard of street illumination. To a limited degree they have begun to realize the inestimable value of a higher standard of illumination. We have installations worthy of considerable praise, but as yet the improvements of which we boast do not compare favorably with standards set in other lines of civic betterment." This paragraph is a good starting point for several interesting lines of thought; amongst others that the educatory process has been a very painful process to the public while the illuminating expert has been trying his nostrums on the "man in the street."

The old carbon lamp and the enclosed arc had gradually swept away the open gas jet and the public were comfortably reading their evening papers by the mellow carbon light, and jeering mildly at the old-fashioned country folk who still believed in the kerosene lamp as "less trying to the eyes."

Came the incandescent gas mantle to challenge the new illuminant, and the education of the public entered a new phase. Gas gave heat as well as light, and would provide hot air of a sort at a great rate in a cold room, and that was a great economy in the winter to the small boarding house, or family of slender means. Gas companies encouraged the mantle for they found that a cheaper gas with lower illuminating power would now satisfy the patient public.

Then with a great fluster the tungsten lamp appeared in the lists—a poor weak thing, with no stamina at all,—but a necessary step in the public's education, for the price of the lamp was enormous, "but the reduction it caused in your first light bill would pay for the lamp." It did pay for the first lamp, but how to pay for the second and third lamp was a burning question between customer and salesman in those days. And the man who with pride replaced his 16 c.p. carbon with a 50 c.p. tungsten backed by a conical porcelain reflector hung just above his head in his small sitting room, spent his second evening trying to dodge the blinding rays. The third evening the lodger upstairs dropped his boots on the floor suddenly and broke the tungsten's spine. Naturally the man felt sore, but such was the progress of his education that—while attempting to claim for a defective lamp—he blamed the clod-hopper of the floor above.

The Nernst lamp assisted for a while in keeping alive the curiosity of the public with regard to new illuminants, for in reliability it was a close competitor of the early tungsten. And it was rather a pretty lamp, but when it decided not to burn an expert was needed to discover which of its many complicated parts—heater, glower, resistance or automatic cutout—had gone on strike. So the tungsten won through, the price being judiciously lowered from time to time to console the customer for his large renewal bills.

When the "wire-drawn" tungsten made its debut the well-trained public hailed with enthusiasm a tungsten lamp which would not break if one sneezed. Speaking candidly, this was the time when the tungsten lamp emerged from the experimental stage, and the public had been trained—not to expect too much of it.

Meanwhile as the earlier tungsten lamps had only been available in fairly large candle-power units, the standard of illumination demanded became higher. Stores and saloons especially used high intensities of illumination, and gave rise immediately to a demand for better street lighting.

The enclosed arc became a drug on the market, and magnetite arcs, flame arcs and tungsten post lighting entered the arena. And with the introduction of the ½ watt tungsten lamp in 250 to 1,000 c.p. units for inside illumination there came the epoch of over-illumination to which this article has especial reference. The writer can think of a Greek store in Montreal where it was, for a time, almost impossible to tolerate the glare for more than a few minutes. Moving picture shows hang 2,000 candle-power flame arcs about 10 feet above the sidewalk. High candle-power lamps are used in small shades which give the appearance of a frill around the socket of the lamp, while the dazzling filament spoils the eyes of the passerby. Even office buildings have caught the infection in the vicinity of the main thoroughfares.

So, street illumination had to be a compromise between what was really required to light the streets and what the public had unfortunately been educated to consider desirable. There is no doubt that post-lighting is showy and decorative and may be quite satisfactory if the units are not high power and the posts are placed close enough together to avoid splash effect. But on a wet night in Montreal it is easier to drive a car up Bleury Street and distinguish approaching vehicles, and street crossings, than along Western Avenue. Yet the latter is far more brilliantly illuminated, even at minimum points, than the former, and most people would agree as to which is the better lighted street.

Ideally speaking, the higher street lights are hung, the easier it is to distinguish approaching traffic, as the light

source is further from the immediate field of vision. The ideal alternative is a string of lights low down and so close together that the illumination on the street surface is uniform along the centre line of the street.

The final layout of any city street lighting is bound to be a compromise, for there are various difficulties that appear almost unavoidable. An intensity of post illumination which is not excessive when the stores along a thoroughfare are brilliantly lighted, may prove dazzling later on in the evening when the store lights are mostly extinguished. Also there is a natural tendency for stores to attempt to outshine the street illuminants with flashing signs and other devices. Let us tell the truth of the matter. As many mistakes are liable to be made, and are made in the education of the public as in the education of children, and the needs of one generation are not usually identical with those of the next generation, even in the important matter of street and domestic illumination.

Street Lighting in Toronto

The annual report of the Toronto Hydro-electric System, just issued, shows that in spite of adverse conditions 9,000 meters were added to their lines during the year 1914. Street lamps to the number of 40,596 are now in use and the peak-load in December reached 28,753 horse-power. The connected load is given as 88,000 horse-power for 31,000 consumers.

Special attention is drawn to the activities of the appliance department where, in the item of irons alone, 5,600 were added during the year. The additional consumption in this direction alone means approximately 480,000 kw. hours per year with an approximate revenue of $13,000.

The report notes various improvements in street lighting during the year, including some changes on certain downtown streets where single light type standards have been installed. A number of residential streets have also been equipped with lighting on the local improvement plan. An example of these is shown in the accompanying illustration —Chestnut Park Road, one of Toronto's prettiest residential streets. On this street the standards are 9 ft. 6 in. high, spaced approximately 80 feet apart and mounted with 100-watt nitrogen lamps enclosed in 12-in. opalescent globes. Service is by special armored cable laid underground.

Another feature of the report is the better lighting that has been installed at several busy intersections of the city. For the most part 500-watt lamps, or less, are used, but at very busy intersections, such as King and Yonge, 1,000-watt nitrogens, enclosed in special diffusing globes and suspended at a good height, have been installed. These intersection installations have given very great satisfaction and added largely in the reduction of accidents at these busy points.

Lighting residential streets on Local Improvement plan.—Toronto.

"I have little confidence in and much sympathy with those who speak of peace—but what is the use of crying 'Peace, peace' when there is no peace, and no possibility of peace? There can be no peace until the authors of this foul war are brought to a condition where their emissaries and the whole world can see that hereafter they will obey our rules, the rule of good faith, the rule of keeping contracts, the rule that when they make a treaty they shall stand by it, whether it is to their interest or not, and forsake this foul code of law which has governed them for the past twelve months—the code that, where their interest requires it, they can throw all treaties and contracts to the winds."

This from no less an authority than the world-renowned United States citizen, Joseph H. Choate. Could a British statesman have expressed it better? Mr. Choate is also, be it noted, an honorary vice-president of the International Peace Conference.

Graphic Illumination Chart—Its Application

By F. R. Ewart

The subject of this article is by no means new. The illumination chart in the form here discussed was developed by Mr. A. E. Parks, and made public by him in the transactions of the Illuminating Engineering Society for October, 1907. Since then it has been included in some of the later handbooks. It is doubtful, however, whether it is very well known or commonly used among electrical men in Canada. It is in the expectation that a more general familiarity with the chart will prove helpful that this discussion has been written.

The simple physical laws of illumination are well known. First, that intensity of illumination varies directly as the power of the source. Second, that it varies inversely as the square of the distance from that source. Third, that for light striking a plane at an angle, the luminous intensity normal to the plane will be the intensity as determined by power and distance multiplied by the cosine of the angle between the ray and the normal to the plane. From these laws are derived the well-known formula

$$IH^2 = C \cos^3 a$$

Where

I = illumination in foot-candles normal to the plane illuminated.

C = candle-power.

a = angle between ray and normal to plane.

H = mounting height in feet above plane.

The equation can equally well be expressed using the sine function instead of the cosine function as follows:—

$$IH^2 \sin^3 a = C.$$

This is the form on which the chart is actually based, the reason being shown later. The principle involved is the addition and subtraction of logarithmic distances in much the same way as on the ordinary slide-rule. In fact it would be quite feasible to build a special slide-rule for this work.

Expressed in logarithmic form the equation reads:

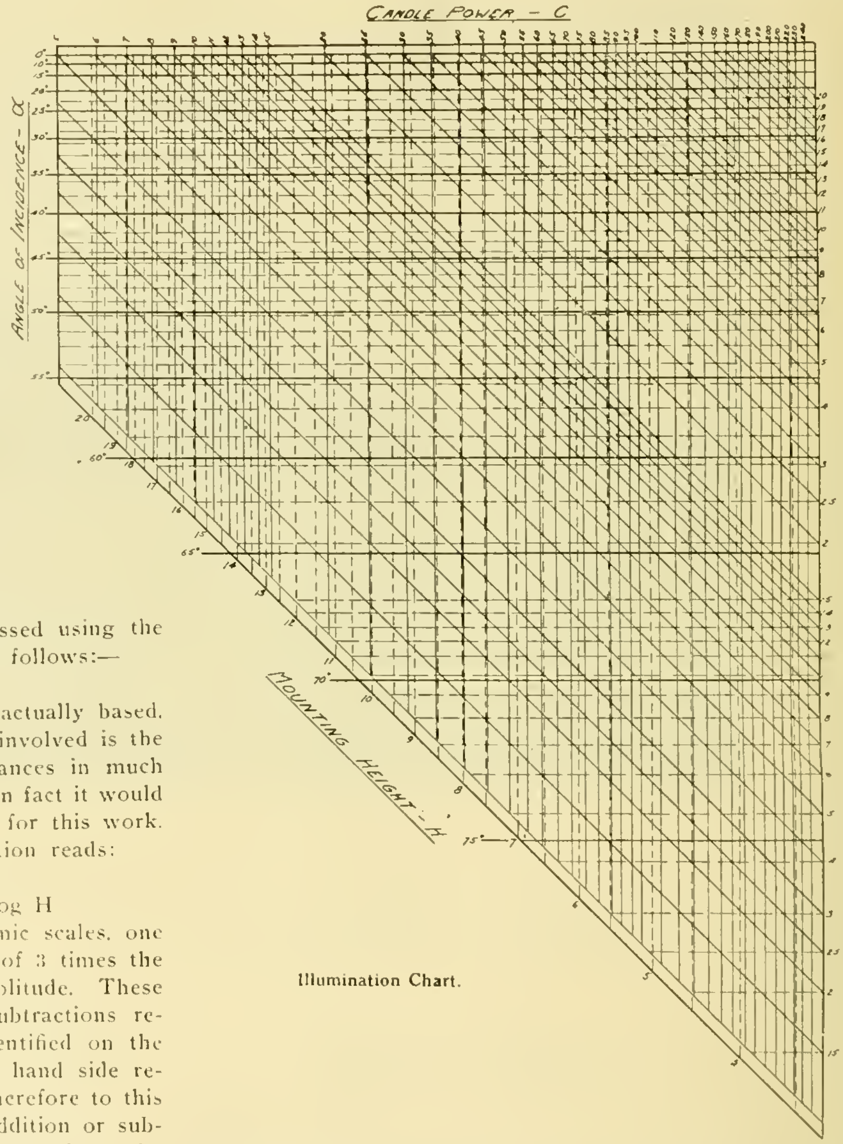
$$\log I = \log C - \log \sin^3 a - \log H^2$$

$$\text{or } \log I = \log C - 3 \log \sin a - 2 \log H$$

The chart then is built of four logarithmic scales, one for log I, one for log C, one for log Sin a of 3 times the amplitude, and one for log H of double amplitude. These are arranged in convenient form for the subtractions required. The four scales may be readily identified on the chart. The scale for I located on the right hand side represents the quantity to be determined and therefore to this scale all quantities must be transferred for addition or subtraction. This scale I is located at a distance along the scale of H where H equals $\sqrt{10}$ or 3.16 approximately. By this means a scale for I is established reading quantities one-tenth those of the corresponding scale for C. Thus the length for 100 candle power transferred to the vertical scale I by means of a 45 deg. diagonal reads 10 foot-candles, which is the intensity given by 100 candle-power at a distance of $\sqrt{10}$ feet.

If, however, the 100 candle-power were in a direction 45 degs. above the vertical but the same mounting height, we would have to subtract the distance corresponding to 45 degs. on our scale for a. This is done by following the vertical through 100 on scale C down to its intersection with the line marked 45 degs. following the diagonal through this point we get a value of 3.5. The distance from 10 down to 3.5 on scale of I being equal to the distance from 0 deg. to 45 degs. on scale of a, we have obviously got a result which represents log C — 3 log sin a.

Now suppose the mounting height to be 6 feet instead of 3.16, but C = 100 and a = 45 degs. as in the previous example. Then follow the horizontal line through 3.5 (the result so far obtained) to its intersection with the vertical



Illumination Chart.

through 6 on scale H. Again follow the diagonal to the right obtaining the quantity 1.0. The distance from 3.5 down to 1.0 on scale I is equal to the distance between 3.16 and 6 on scale H. We have, therefore, subtracted from our previous result that part of 2 log H not already taken care of by the choice of location for scale I. The final result then gives a distance representing

log C — 3 log sin a — 2 log H, this net distance being equal to log I according to the equation.

The rule then for the use of the chart is:—

Follow the vertical through value of C to its intersection with horizontal through value of a. From this intersection follow diagonal to right hand margin. Continue along horizontal to left to intersection with vertical through

value of H. From this intersection follow diagonal again to right-hand margin. Read foot-candles (I) from scale at this point.

The reason for using the sine function instead of the cosine function should now be fairly apparent. By making both operations subtractions one set of diagonals will serve. If, on the other hand, one operation had been an addition, a set of diagonals would have been required running from the lower left hand to the upper right hand. This would obviously make the chart much more confusing.

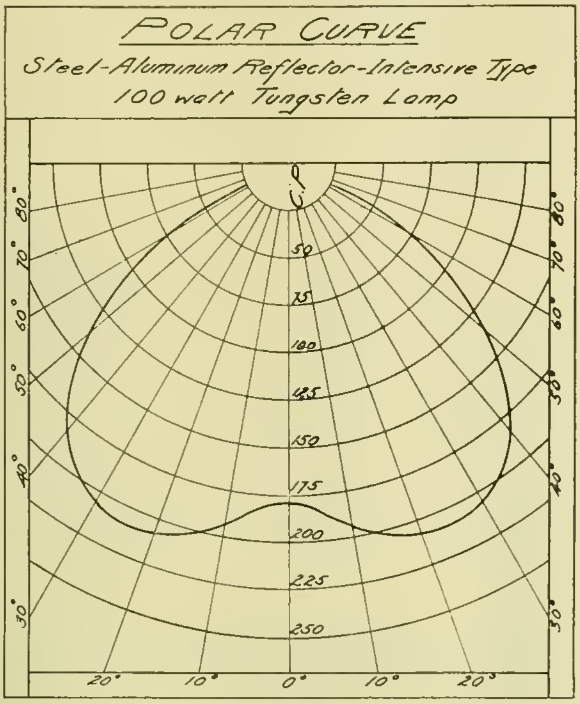


Fig. 1.

The location of the scale I at a point on scale H equal to $\sqrt{10}$ works out most conveniently in bringing the scales into agreement without further subdivision. It is only rarely that mounting heights of less than 3.16 feet need be considered. Where such cases do occur the chart may be readily extended to the right to cover these lower values.

The chart in the form shown will readily serve for the solution of problems involving candle-powers much greater than 200, as in the case of large gas-filled lamps, arc lamps, etc. Since I varies directly as C, we may divide C by any convenient divisor such as 2 or 10 and multiply the final result by the same number. This would give exactly the same results as solving the problem on a chart of wider range.

As an example of the use of the chart in determining the resulting illumination from a definite light source, consider an ordinary polar curve as shown in Fig. 1. From this take the candle-power at various angles and work out the intensities over a working plane 3 feet above the floor for various mounting heights, say 8, 10 and 12 feet. The results in tabulated form would appear as follows:—

Mounting height		8	10	12
	H.	5	7	9
a	C.P.	Curve A	Curve B	Curve C
0	180	7.5	3.8	2.3
10	194	8.0	3.9	2.4
20	208	7.2	3.6	2.1
30	206	5.4	2.8	1.7
40	181	3.4	1.7	1.0
50	136	1.5	.7	.5
60	74	.4	.2	.1

The checking of all, or even a few, of these readings will readily show the working of the chart. Now if these values be plotted as ordinates on base of feet, the resulting curves will appear as in Fig. 2. A simple table of striking distances from the vertical along the plane for various angles and mounting heights may easily be prepared, and will prove of great assistance in plotting these curves. The pronounced effect of mounting height becomes most strikingly apparent. Curve A shows that a height of 8 feet is ordinarily too low for good results. It will result in a ring of light of very high intensity dropping off very rapidly within a short distance. Curve B is a well-shaped curve which can be used to good advantage as shown later on. Curve C is also a normally shaped curve but indicates that a height of 12 feet will give much less illumination with probably little or no corresponding advantages.

Now suppose 10 feet to be chosen as a suitable mounting height. Take two identical curves like curve B and space them 8 feet apart centre to centre on a sheet and add the two curves. Try the same thing for 10 feet and 12 feet. The results will be typical of the illumination along a row of units and appear as in Fig. 3. It appears from these, that on 8-foot centres there will be an excess of illumination midway between the two sources. At 12 feet, on the other hand, a considerable sag appears at the same point. But 10 feet seems to be just about right, giving a variation of only 6 per cent. below the maximum instead of about 25 per cent. as in the other two cases. Probably about 9 feet 6 inches might even give a curve of slightly less variation. If a uniform general illumination of about 4.5 foot-candles over the working plane represents the result desired, it appears that a unit having the polar curve of Fig. 1 placed at a mounting height of 10 feet and spaced on 10-foot centres will solve the problem excellently.

If the reader is interested in further experiments with curves he might try the following exercises:—

1. Take Curve A, Fig. 2, and determine about what spacing will give the most uniform illumination.

2. Take Curve C, Fig. 2, and find the greatest spacing which may be used without permitting a variation of more than approximately 20 per cent. below maximum.

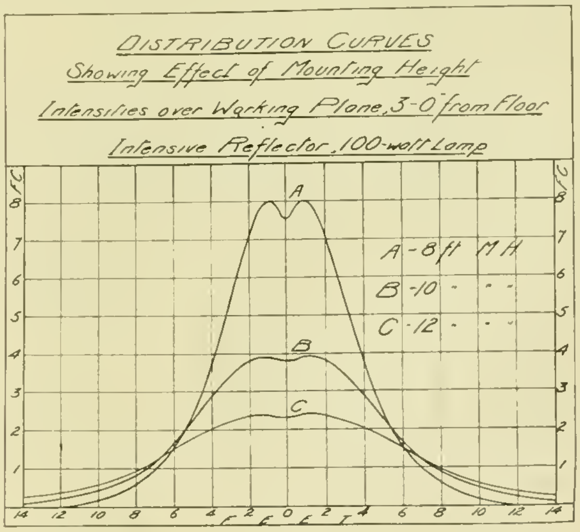


Fig. 2.

3. Take the polar curve of a bare tungsten lamp and find what combination of mounting height and spacing will give the most uniform result. (This exercise will prove most enlightening).

The chief value of the illumination chart is in its great facility. Anyone accustomed to its use can take any polar

curve and in 10 minutes have a set of curves such as Fig. 2. A second 10 minutes will produce a set such as Fig. 3. Given a polar curve (the fundamental illumination data of any

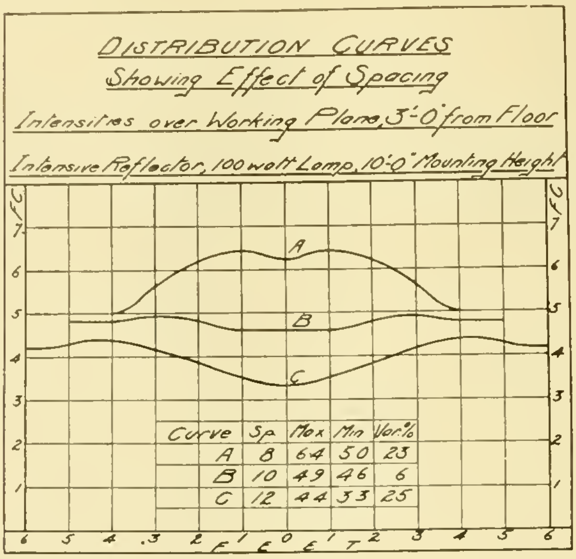


Fig. 3.

lighting source) you can know pretty surely in less than 20 minutes just what you can accomplish with it. All the heavy mathematical calculation is eliminated and the chances of error reduced to a minimum. Under such circumstances there does not appear to be much reason to guess at illumination. A reasonably accurate polar curve can be taken from any form of light source, provided only that it is constant. Indirect and semi-indirect sources naturally present additional complications over the direct proposition but they are far from insurmountable. It is therefore quite within reason to expect any manufacturer of illuminating equipment to furnish actual photometric data.

It is not contended that the actual physical quantities involved are the only things that matter in the solution of illuminating problems. Other considerations, which cannot be estimated quantitatively may prove of much greater importance. But when the physical values can be so easily and accurately determined, they should be applied as a check on every solution.

The municipality of St. Raymond, Portneuf County, P. Q., have just put into operation a new hydro-electric plant, for the supply of current for public and private lighting and for power purposes. The plant, which replaces an old belt-driven set, consists of a 110 h.p. vertical wheel running at 225 r.p.m., under a head of 14½ feet; the wheel is set in open flume, and is direct connected to a 75 kv.a., 3-phase, 60-cycle 2200 volt vertical generator. A new substation of concrete has been built. The engineers were Messrs. Gauvin & Beauchemin, Quebec, and the contractor Mr. J. N. Mouchon, Montreal. The wheel was supplied by the Boving Hydraulic and Engineering Company, and the generator by the Canadian General Electric Company.

New Street Lighting for Chatham, Ont.

By M. B. Hastings

The benefits of better street lighting are now so evident that to dwell on them seems like a waste of words, yet with the development of cheap power in Ontario it may be interesting to study the subject for a few moments to see just why it is becoming so popular.

In the first place, as a profitable investment, better street lighting pays. Merchants know it pays and the merchant on that part of the street with poor lighting will, if he be wise, move to the other part of the street or loudly advocate improvement in the lighting on his own section. Good street lighting is a paying investment because it is a good advertisement. People see it at night as well as in the daytime and are pleased or displeased according to the impression made. Good street lighting, more than anything else, gives a city or town an air of progressiveness and prosperity. It is a paying investment.

Further, good street lighting is a means of providing public safety. It has often been said that every light is the equivalent of a policeman. This may not be literally true, but the fact remains that with the immense increase of automobiles, etc., the question of public safety at night becomes an issue of grave importance. The tendency seems to be to turn night, or part of it, into day. The days of the moonlight schedule are past, and to consider the phase of the moon in a public lighting system is as far behind the times as regulating the planting of crops or the prediction of the weather on a similar basis. A city should not only be lighted up adequately in every part, but should be kept lighted fairly well during the entire part of the twenty-four hours when sunlight is not available. Utilized in this way, good street lighting is perhaps the greatest aid to the Safety First movement, and accident prevention is one of the best forms of municipal economy.

From a sanitary standpoint street lighting pays. The power of suggestion is very influential and there is no denying the fact that one improvement suggests another. The asphalt pavements are not clean altogether because they are easier to keep clean; it is because they look better clean. Well lighted streets will be kept cleaner because it will be both easier to find the dirt and because they will look better clean. Not only will good street lighting be an incentive to keeping the streets clean and sanitary but will further react upon the residents themselves with a wholesome in-

Fig. 1.—King Street, looking east, Chatham.

fluence towards cleanliness. Therefore, as a sanitary measure it is a profitable investment.

Good street lighting is an incentive to civic pride. Every citizen should be able to point with pride to his own city and how can he do so if he sees a woeful deficiency in the public street lighting? He may not be able to pass on the relative merits of the public libraries or the architecture of the public buildings, but it is fairly certain that public street lighting is of such a conspicuous nature that it will not escape the notice of the most unobserving citizen. Surely it

pays to try and make every citizen a "booster" for his own town.

Last, though not least, must be mentioned the psychological effect of good lighting. Dark streets and by-ways have a depressing effect on the human mind. Good lighting makes you feel better, puts you in a confident frame of mind —literally and metaphorically broadens your vision. Men and women who live in darkness show a tendency to lose control of their faculties for observing, just as several well-known varieties of cave fishes have become stone blind by living without light. Is it economy for any municipality to save money at the expense of its citizens' mental or physical faculties?

In view of the above reasons for good street lighting it is not hard to understand why Ontario has gone ahead in this respect by leaps and bounds. Further, the development of cheap power along our rivers and streams has made it easy for Ontario towns and cities to acquire good street lighting at small cost. One of the latest to join the ranks is the city of Chatham.

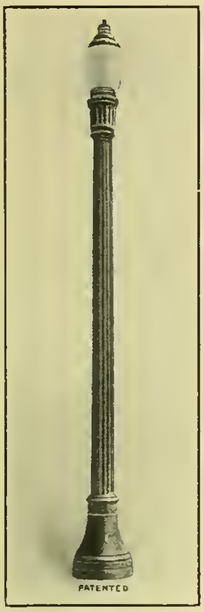


Fig. 2.—Large Whiteway Standard.

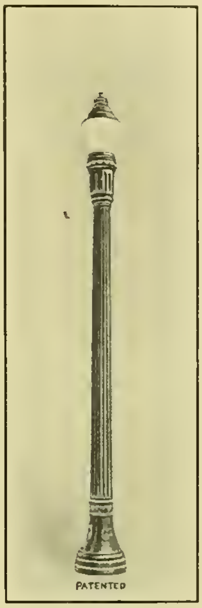


Fig. 3.—Intermediate Whiteway Standard.

Fig. 4.— Parks and Boulevard Standard.

The city of Chatham has perhaps one of the most modern street lighting plants in America. It is a completely new system, making use of the latest types of units for whiteway lighting, main thoroughfare lighting, park and boulevard and residential lighting. Over a good part of this system underground construction is used. It is an incandescent series system throughout with nitrogen filled lamps. From the illustration, Fig. 1, it will be seen that the night view of the streets of Chatham is exceedingly beautiful, and vehicular and pedestrian traffic is as safe and pleasant by night as by day.

The current is supplied from the high tension system of the Hydro-electric Power Commission of Ontario and is stepped down to 2200 volts. Constant current repulsion type transformers are used to supply current at 6.6 amps. Combination potheads and series cutouts are used in the base of the pillars; these not only effectively seal the cable but act as absolute cutouts also.

Fig. 5.—Residential Unit, Chatham.

When determining the location of the standards care was taken to have them as equally spaced as possible and uniform illumination was obtained by staggering the standards. Sometimes too much importance is placed on having four standards at each intersection with the result that the unequal spacing spoils the good appearance of the street and defeats the object. This was avoided in Chatham Streets.

Figs. 2, 3, 4, and 5 represent the types of units used on the streets. To give a pleasing effect Crystophane glass was used which possesses excellent qualities, both with respect to good diffusion and low absorption. The fixture is designed so that a prismatic refractor can be used if desired.

An ornamental bracket with steel radial wave reflector is used in the residential sections. This type was used because it would be wasteful to allow unnecessary light to go towards the illumination of the tree tops. The close spacing of these units make the residential districts very attractive and safe.

As mentioned above, this is a 6.6 amp. series system and was decided upon because of the entire satisfaction of other series systems as compared with multiple systems. The higher current lamp is very satisfactory from the manufacturers' standpoint and because of the popularity of the

Table giving details of Chatham's street lighting.

Streets	Type of Standards	Size of Lamps	Height of Lamps	Spacing of Lamps	Type of Construction	Location
Important Business Streets	Large pole top, No. 13336. Series circuit.	750 C.P. 6.6 amp. Crystophane outer globe.	14 ft. 6 in.	125 ft. 0 in.	Underground Fibre conduit Lead covered cable. Series Potheads.	Staggered.
Important Thoroughfares	Intermediate pole top, No. 12349 Series circuit.	600 C.P. 6.6 amp. Crystophane outer globe.	12 ft. 3 in.	200 ft. 0 in.	Underground Armoured cable. Series Potheads.	Staggered.
Parks and Boulevards	Small pole top, No. 11337 Series circuit.	150 C.P. 6.6 amp. Lumo outer globe.	10 ft. 0 in.	200 ft. 0 in.	Underground Armoured cable. Series Potheads.	Staggered.
Residential	Bracket No. 2303. 3 ft. projection.	150 C.P. 6.6 amp. Steel radial wave reflector.	15 ft. 0 in.	115 ft. 0 in.	Overhead No. 6, D.B.W.P. medium hard drawn copper.	One side of street.

6.6 amp. circuits this size is a much better lamp to stock than any other size. From a year's records it is safe to conclude that the life of the nitrogen filled lamps on series systems is twice that of those on multiple systems, and after carefully observing operating conditions it seems reasonable to attribute this result to the use of a constant current transformer because, in the first place, the method of throwing the circuits on with a constant current transformer eliminates the high starting current so characteristic of nitrogen filled lamps. After the circuit is on, the constant current transformer never allows the current to vary more than one-tenth of an ampere. Absolute control of the whole circuit is in the hands of the operator who can easily lower the current slightly at midnight if it is desired to increase the life of the lamps.

The principal features of the new Chatham street lighting system are given in the table on page 51.

Surely it is easy to understand why better street lighting makes the citizen wonder how he got along with the old system. Your good impression and your well lighted streets remain long after the cost of the installation is forgotten. From every point of view better street lighting is a profitable investment.

The Orangeburg fibre conduit, ornamental standards, pole top fixtures, G. & W. series potheads and Pemco series fixtures were supplied by A. H. Winter Joyner, Limited, Toronto. The cable was supplied by the Standard Underground Cable Company of Canada, Limited, and the Northern Electric Company, while the transformers were supplied by the Canadian General Electric Company.

The installation was carried on under the direction of the Hydro-electric Power Commission, with the co-operation of Mr. J. G. Jackson, manager of the Chatham Hydro-electric System.

Cluster Lighting of Victoria's Busy Streets

By M. Hutchison, City Electrician.

One of the finest examples of attractive street lighting in Western Canada is that of Victoria, B.C. This system was installed as a work of local improvement, and covers the central portion of the city, extending over eight miles of streets. Each standard carries five lamps of 40 candle power each, and the spacing is approximately 80 feet, standards being placed directly opposite on both sides of the street.

Installation.—The whole cost was charged to the property owners (fronting on streets covered by the system) and is collected in ten annual payments.

Maintenance.—The city supplies all power required for operation of the system, and all other maintenance charges are paid by the property owners, the charge this year being at the rate of seven cents per foot front.

Operation.—Alternate standards are switched off at 11 p.m., the balance being continued in operation throughout the night.

Number of poles in regular service	1010
Number of lamps in regular service	5050
Lamp renewals during 1914	1674

Distribution is by means of underground cables operating at a primary voltage of 2200, reduced to 110 in manholes. A further reduction to 8 volts at lamp terminals is made by use of a lowering transformer in each pole base. The system is a duplicate two-wire system throughout in order to avoid interruption to service in case of cable trouble, and the whole system is controlled from the city lighting station by means of suitable regulators and oil switches operating on the primary supply.

The cost to the city during 1914 was $6,000, and arc lamps costing $3,000 per annum were removed and put into service in the outer districts, so that the extra cost of the cluster system over that which the city would ordinarily have furnished does not exceed $3,000 per annum—a very small sum, in my opinion, taking into consideration the vastly improved appearance of the streets. We are adopting the nitrogen-filled lamps for future use, so that the above amount will be reduced by anywhere from 30 to 35 per cent. The bulk of street lighting in outer districts is by means of 4-ampere magnetite arcs, and the system has given us very satisfactory service, the number of arcs in use being 900.

We purchase power required for street lighting service at a rate of 1.07 cents per kw.h.

Business Street Lighting, Victoria, B.C.

Illumination and One Year's Accidents

By R. E. Simpson*

There is a widespread belief prevalent to-day that there are approximately 500,000 avoidable accidents per year in this country, and that about one-quarter of this number are caused directly or indirectly by improper lighting facilities. So far as can be learned these figures are estimates made by persons who have had considerable experience in accident-prevention work. There is little evidence to show that any systematic effort has been made to point out the relation between light and accident rate. This is due to the want of statistical data, owing to the enormous labor and expense involved in obtaining such data. A number of men interested in good lighting or in accident prevention, or both, have pointed out the many ways in which the lighting of a factory may influence the accident rate. In some instances studies were made of certain industries, notably by Mr. D. R. Wilson, special inspector in the Factory Inspection Service in Great Britain, who in 1911 and 1912 investigated the lighting conditions in British textile industries and in foundries. In neither one of his reports are there data to enable one to ascertain the percentage of accidents due to the inadequate lighting conditions described.

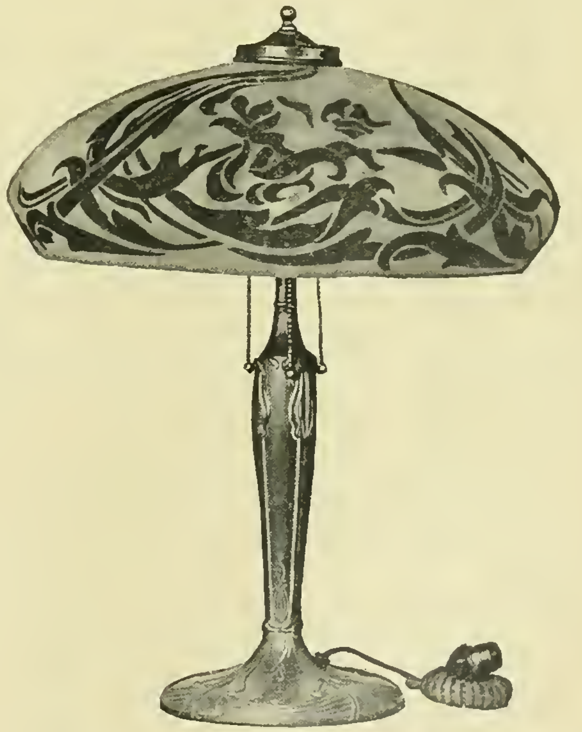
At about the same time, Mr. John Calder presented a paper before the American Society of Mechanical Engineers, showing the increase in the number of fatal accidents during that part of the year when the ordinary factory working hours, 7 a.m. to 6 p.m., extend beyond the daylight period. The curves presented with his paper showed conclusively that the number of accidents in December and January was forty per cent. greater than the normal number that might reasonably have been expected if there were the same number of daylight hours in the winter as in the summer.

The records of workmen's compensation and accident insurance companies offer a fruitful field for the study of accidents, provided particular attention is given to details in the investigations. In this respect a few notes on the lighting arrangement will often explain the cause of an accident. The Travelers Insurance Company is particularly fortunate in having over 200 men who are specialists in accident-prevention work. A record is kept of every accident in and about factories, shops, and mills carrying insurance with the Travelers, and all important ones are investigated by the inspectors, who ascertain the conditions that prevailed at the time of the accidents. The reports of these men form an authoritative library on causation and prevention of industrial accidents, and among the causes, and the recommendations for the prevention of future accidents, the lighting question plays an important part.

The main object of this paper is to present the results of a study of these reports covering a period of one year from January 1 to December 31, 1910. All accidents incident to the use of automobiles, teams, bicycles, trolley cars, and slippery pavements are omitted, as well as all accidents occurring in and about coal mines. While there is absolutely no doubt that the darkness of a coal mine, broken only by the feeble light from the miner's lamp, is largely responsible for many coal-mine accidents, there are so many other factors bearing on the subject that reliable conclusions cannot be drawn. It is worthy of note, however, that the introduction of electricity for haulage purposes has provided the coal operators with a ready means of lighting the more important switching points in the mines. The use of steel and concrete for roof support, and the application of whitewash to the roof and sides at the turnouts, switching points, and shaft bottoms, materially increases the illumination. Good lighting is essential here in order that the motorman may see that the switches are properly set, and that no standing cars block his way, thus enabling him to avoid derailments and collisions. The other employees at these, the busiest parts of the mine, can also perform their duties much more efficiently and safely because of the better illumination.

Excluding these classes of accidents, there still remain more than 91,000 accidents which occurred in and about industrial plants; and of this number 23.8 per cent. were due, directly or indirectly, to the lack of proper illumination. This figure, 23.8 per cent., corresponds very closely to the estimate of 25 per cent. already mentioned. There is this difference, however, in that the estimate of 25 per cent. was based on avoidable accidents, while the 23.8 per cent. obtained from the Travelers Insurance Company's records embraces both avoidable and unavoidable accidents. It is evident from the records that a large number of the accidents were unavoidable, particularly in those instances where the lighting condition was a contributory rather than a direct cause.

A further analysis of the records shows that 10 per cent. of the total industrial accidents for the year were due primarily to inadequate illumination, and in the remaining 13.8 per cent. the lack of proper lighting facilities was a contributory cause. It is probable that another person in going over these records would arrive at different percentages of direct and indirect causes of accidents due to the illumination, but this would simply represent a difference of opinion in those cases where equally good arguments might be put forth in favor of one view or the other. The essential



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* Paper presented at the ninth annual convention of the Illuminating Engineering Society, Washington, D.C., September 20-23, 1915.

feature of the analysis is the large percentage of accidents in which the illumination had an important influence.

Under the heading "direct cause" were included all accidents on stairways, in passageways, or in the shop where it was shown that there was no light in the immediate vicinity. It is true that many persons have been injured by falling down stairways that were well lighted, and, therefore, the illumination could have had no bearing on the accident. It is likewise true that if none of the stairways in the country were provided with light, the accident rate from this cause would be vastly increased.

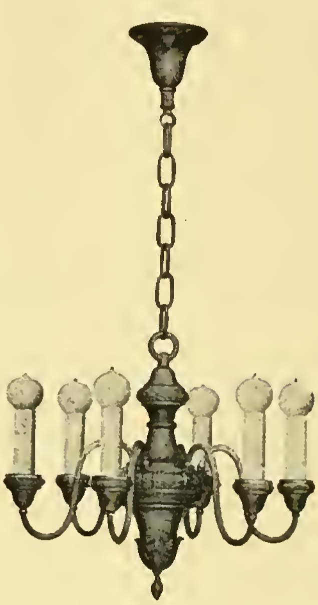
It may be interesting to cite a few typical cases where insufficient or improper illumination was a cause of an accident. In a certain shop having widely spaced lighting units a supporting column cast a shadow which hid a flat 2-inch bar lying at an angle across the passageway on the floor. When one of the front wheels of a truck encountered the bar, the truck axle, swerving sharply to the right, jerked the handle out of the laborer's hand and struck the right foot of a workman standing at the side to let the truck pass. The blow broke one of the small bones in his foot. The sudden stopping of the truck also caused one of the heavy pipes on it to roll off, and the truck handle, acting as a skid, guided the pipe against the workman's left leg, breaking both bones below the knee. It is evident that neither man saw the bar of iron on the floor, a fact which is easily understood when one considers that the floor and the bar were both dark-colored, and further obliterated by the shadow. It is fair to assume that had adequate light been provided, one of the workmen would have seen the bar, and would have removed it instead of attempting to pull a heavy truck over it.

A paper-mill employee, while feeding a conveyor with short pieces of pulp wood, noticed that the chute at the other end of the conveyor had become clogged. There was no light at the chute, nevertheless the man after stopping the conveyor attempted to clear the way, and while thus engaged a block of wood slipped out and broke his ankle. There was no occasion for any of the workmen using this part of the mill unless the conveyor or the material caused trouble. This, however, was just the time light was needed and none was provided. The amount of money required to maintain a unit affording ample illumination at this point is neglgible when compared with the amount of the claim paid the injured workman; in fact, such a unit could have been kept burning all day, and every day for a hundred years, and still the owner would have realized a handsome profit; and one employee, at least, would have been saved from injury.

The following two instances represent conditions often seen in certain industries. In the first one, a man fell into a tank containing hot water and acid, and was fatally burned. A number of tanks were placed close together, with narrow walks between them at the top. There were no guard-rails along these walks, and no artificial light was provided, even though the presence of workmen at this point was necessary at odd times of the day. The accident happened just before quitting time in the latter part of December. In the other instance the natural light was not adequate and was supplemented by incandescent lamps. Both the lamps and the windows had a thick coating of grease and dirt, so that by no stretch of the imagination could the illumination be called other than very bad. Nor were there any guard-rails along the walk at the top of the vats containing scalding water. It is not to be wondered at that a workman made a mis-step and was scalded to death.

In another case lack of light in the hold of a vessel was, without doubt, responsible for a crushed foot. A workman was piling pig iron there, in semi-darkness, the open hatch, far above, admitting so little light that he could not see that the pile was uneven. While he was still at work the pile toppled over and injured him, as stated. Under exactly similar conditions another workman could not see that a hook was insecurely caught in a bale of cotton that was to be hoisted from the hold of a steamer, and when the hook slipped the falling bale struck the man a glancing blow, breaking his collar bone. In this instance the difference of a few inches in the man's position was all the margin there was between injury and death. In the punch-press room of a certain factory an overhead skylight provided plenty of illumination on bright days, but in the winter months ,and especially on gray, cloudy days, the daylight illumination was so much reduced as to occasion repeated requests for auxiliary artificial light; and an injured workman based his claim for damages on the ground that the employer had failed to provide sufficient illumination.

Two steamfitters, having finished some work on a tem-



Candelabra design Moran & Hastings, Chicago

porary platform 9 ft. above the floor, instructed a laborer to remove all supplies and tools. The steamfitters had used an extension cord drop-light which they took away with them, thus compelling the laborer to depend on the reflected light from the units below him. He failed to see a short piece of steam pipe, which soon afterward fell on a workman below, fracturing his skull. This is the type of accident generally classed under the term of "struck by falling material." It is probable that if sufficient illumination had been provided, the laborer would have seen the pipe and taken,it away with the other material, thereby preventing the accident; and under the circumstances it is certainly fair to state that the lack of illumination was a contributory cause.

Two trucks being pushed in opposite directions collided on an overhead bridge, and both truckmen were injured by material falling from the trucks. The noise in adjoining shops, in addition to that caused by the trucks themselves, prevented each truckman from hearing the approach of the other. The covered bridge had side windows, but no other means of providing light, and as the accident occurred late in the afternoon in January, the lack of light plus the noise were responsible.

A machine with four saws on one shaft was well guarded, but the drop-light had been so arranged by the operator that one of the guards cast a deceiving shadow. The man thought he was placing his hand on the guard, but instead he placed it on the shadow and was badly injured. This

was purely a case of improper lighting, and it points out the hazard in the practise of permitting a workman to adjust the lighting units to suit his own convenience, instead of having them placed by a lighting expert who has studied the safety problem carefully.

A workman using an extension-cord light found it necessary to use both hands, and he, therefore, made a loop of the cord and hung it about his neck. The worn-out insulation of the lamp cord allowed sufficient arcing to set fire to the man's celluloid collar, causing extremely painful burns about the neck and head. In this, as in most other accidents, a great many "ifs" might be thought of; but none of them can hide the fact that there were no permanent means of lighting the section of the shop in which this particular accident occurred.

Finally, there may be mentioned the correlation between a workman's broken wrist and the rather prosaic escape of two hogs from a pen. No doubt all would have gone well had not one of the hogs elected to sleep on the path between two buildings in a plant. True to his name and nature, the hog obstructed the whole width of the path, causing the workman to stumble over him. There was no means provided to light this pathway, even though it was the direct route between the buildings, and as such was in constant use.

There were several cases where inadequate illumination had impaired workmen's vision, so that these men were subsequently injured while working under lighting conditions that were excellent for normal vision. Their claim that their injuries were due to insufficient lighting was hardly justifiable when applied to the last working place, but it is certain that the impairment of their eyesight due to the poor lighting at their previous work-place had an important bearing on the case.

At the beginning of this investigation an attempt was made to classify the accidents due to the lighting conditions in greater detail than "direct" and "indirect," but this soon proved to be impracticable. If the same proportion had prevailed throughout the records as was evidenced in the first 5,000 cases investigated, the lighting accidents on stairways, passageways, and other seldom-used parts of shops would have had by far the highest rank. It is very generally recognized by illuminating engineers that these are just the places that are likely to be slighted in the original installation, or the maintenance, of factories equipped and operated by the rule-of-thumb method. If one compares the number of accidents that occur at these points, bearing in mind the relatively short time that they are used by a few men, with the number of accidents occurring in the better lighted shops, again having in mind the large number of men and the greater length of time they are subject to the hazards, it is found the accident rate, in the first-mentioned places is abnormally high. It is impossible to draw any other conclusion than that the lack of illumination is largely responsible.

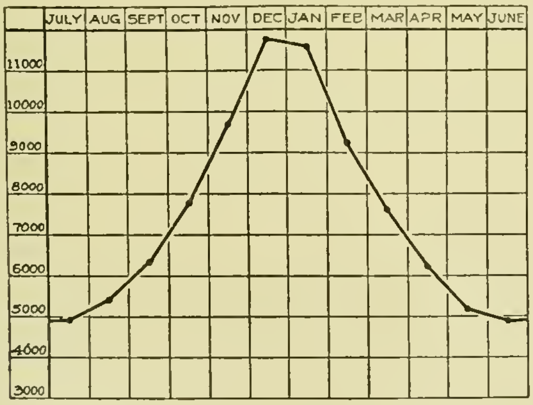


Fig. 1.—Seasonal distribution of all industrial accidents for the year.

Fig. 1 shows in a diagrammatic form the monthly distribution of all the industrial accidents reported for the year, and Fig. 2 shows a similar distribution of all the accidents caused by inadequate illumination. There is a striking similarity between these curves and those published by Mr. Calder and other investigators. From Fig. 2 the fact may be deduced that 51.6 per cent. of the accidents due to poor illumination occurred in the months of November, December, January, and February, while 48.4 per cent. occurred in the remaining eight months. This indicates that the likelihood of an accident being caused by poor lighting is more than twice as great in any one of these four months as in any one of the remaining eight months.

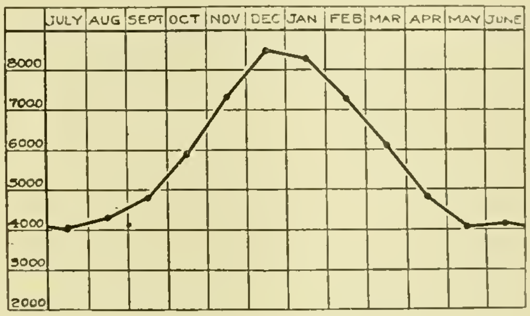


Fig. 2.—Seasonal distribution of industrial accidents caused by inadequate illumination.

Fig. 3 shows the seasonal distribution of accidents exclusive of those in which the lighting conditions had an influence. It will be noted that the increase in the accident rate in the months of November, December, January, and February, is not so pronounced as in Figs. 1 and 2. If the lighting condition was the only factor contributing to the increase in accidents in the winter months, the curve in Fig. 3 would be practically straight. The similarity of the three curves raises the question as to whether or not a greater number of accidents than those shown were due to the lighting conditions. It is probable that the lack of information in some of the reports is responsible for a certain number of accidents attributed to the lighting conditions being overlooked, but just what this number would be is purely conjectural.

There is another factor which will help to explain the increase in the accident rate in winter months, and in this the lighting conditions play an important part, though it is impossible to obtain any reliable figures. It is partly psychological and partly physiological, but may be better understood by referring to it as the depressing effect of cold and dreary weather on mankind. It is a well-known fact that the members of an exploration party to the Arctic region are carefully selected not only for their scientific attainments, but also for their physical and temperamental fitness to withstand the rigors of the weather and the strain of the

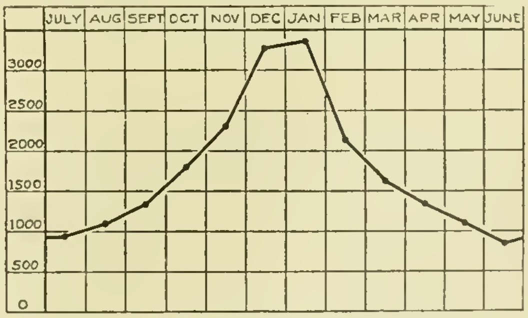


Fig. 3.—Seasonal distribution of industrial accidents exclusive of these due to inadequate illumination.

long hours of darkness. Notwithstanding this careful selection, the history of almost every Arctic expedition records the failure of some of the men under conditions which would have been easily surmounted if they had prevailed at the beginning of the expedition. The immense cold and the cheerless outlook brought about by the lack of comforts craved by the human body, coupled with the long stretches of darkness, render the men unfit for their work.

We do not have such extremes of coldness and darkness, nor such lack of associations or bodily comfort, in our industries. On the other hand, our workmen are not selected to bear up under such conditions. Everyone is aware of the depressing effect of a week of overcast skies with a more or less steady rainfall. Substituting cold weather and snow for rain, one can picture the conditions that prevail in the winter months. Colds and other ailments are more prevalent in winter, and the afflicted workmen are less able to guard against injury. Then again there are many buildings where the window area and arrangement affords inadequate illumination on cloudy days, even when it is satisfactory on bright days. This is a condition that is likely to be overlooked by the inspector if he makes an inspection on a bright day. It is quite evident that a large number of accidents might occur under these conditions, and little, if any, thought be given to the underlying cause.

It is hoped at a later date to make a study of the accidents for the year 1915, in order to ascertain what influence, if any, the educational campaign of the Illuminating Engineering Society, the lamp manufacturers, the insurance companies that have studied this matter, and others interested in good lighting, has had on the reduction of accidents. An examination of a few of this year's reports indicate the trend of the times in that five years ago general expressions such as "no light" or "insufficient light" were commonly used in describing the cause of an accident, whereas at the present time we meet with much more definite statements, such as "improperly placed lighting units" or "low-hanging, unshaded lamps." From this one may gather the cheering information that the workmen are gradually appreciating the vast difference between light and illumination. It might be expected that fanciful claims will be made, such as that put forth by an injured workman to the effect that the actinic rays of the lighting unit impaired his vision. The lighting unit in question was a 16-candlepower carbon lamp equipped with a bowl-shaped aluminum-finish reflector.

A statement has been made to the effect that the introduction of the high-efficiency lighting units was the largest single factor for the increase of accidents in our industries during the period of artificial lighting. This statement is not taken as a condemnation of these lighting units, but rather as a protest against the common method of using them. There are hundreds of small manufacturing establishments in this country, each one occupying a single floor or part of one floor in a building. The owners have had the floor wired and connected for central-station service or piped for gas service. They have procured incandescent lamps, gas tips, or mantles, as the case might be, and used them without proper accessories. Of diffusing glass, reflector equipment, mounting height, and other fundamentals of good lighting they either know nothing or care nothing. The workmen adjust the units so that they can "see," the adjustment generally consisting in placing the lighting unit close to the work, very often between the man and the work, and almost always in the direct line of vision. The carbon lamp or the open-flame gas light contributed a distinct hazard under these conditions, and the hazard was greatly increased when the high-efficiency gas mantle and electric lamp were substiuted without any other change being made at the same time.

In some cases the meterman is the only public utility representative to visit these small manufacturing concerns, and very little advice on the lighting conditions is given by these men. The consulting engineer or lighting expert is seldom, if ever, called in to give advice on installations where the total connected lighting load is in the neighborhood of one kilowatt. In the larger manufacturing plants the lighting bill will bear about the same proportional relation to overhead expense as it does in the small shop, although the bill itself will be many times larger. Economy has generally influenced the management in securing expert advice on the lighting question with a noticeable improvement in the illumination. This in a measure accounts for the modern lighting equipment in the large plants and also shows why they compare so favorably with the small establishments. A workman may be just as seriously injured in a small shop

Types of "Benjamin" Industrial fixtures—moisture and dust proof.

as in a large one; in fact, the accident rate due to the lighting conditions is likely to be higher in the small shop than in the large shop doing the same class of work. The accident insurance companies are assuming risks in the small shops as well as the large ones, and once a policy is written the premises must be inspected periodically. It is the duty of the inspector to prevent accidents by recommending changes in conditions which tend to cause injuries to workmen. Since inadequate and improper illumination is recognized as a cause of accidents the insurance company inspector tries to improve the lighting conditions, and in this capacity he is probably the most potent factor for improving the illumination in the small shops.

In the past year the gas-filled tungsten lamp has become an established commercial product in a constantly increasing range of sizes for multiple circuits. The concentrated filament of this lamp, more nearly approaching a point source, coupled with its higher intrinsic brilliancy as compared with other tungsten lamps, makes the use of reflectors absolutely essential. The manufacturers are earnestly insistent that users equip these lamps with proper reflectors, but unfortunately this advice is not always followed. In some instances shallow dome-type reflectors were used with the vacuum-type tungsten lamp, but when the gasfilled lamps were substituted no change was made with respect to the reflector equipment or mounting height, even though the light sources were within the range of vision. Excellent results in the way of diffusion and distribution can be and have been obtained by the use of the dome-type reflector with the gas-filled tungsten lamp, but when viewed from the safety standpoint they should never be used together, unless the mounting height is such as to preclude any possibility of the lighting source being within the range of vision. Unless this principle is followed it is inevitable that the eyesight of the workmen will be impaired, and with impairment of a workman's eyesight comes a greater likelihood of injury.

Tenders have been received for the construction of a hydro sub-station at Exeter.

Boulevard Lighting in Maisonneuve, P. Q.

The city of Maisonneuve, P. Q., have of late spent a large amount of money in building a market, improving the street lighting, and constructing one of the finest fire stations in the country. From the electrical standpoint, the market and street lighting present the most interesting points. The market is situated on Ontario Street East, standing a considerable distance from the main street, and faced by a large square and fountain. It consists of two floors and a basement. Outdoor stalls or shops are built on all four sides of the market, on a level with the ground floor; in the interior there are also a large number of stalls.

The basement contains a refrigeration plant, a pumping plant for obtaining water from an artesian well, a transformer room, etc. Current is delivered by the Montreal Public Service Corporation at 2200 volts and stepped down to 550 volts for power and 110 volts for lighting. The three lighting transformers were supplied by the Canadian Crocker Wheeler Company, St. Catharines, and the power transformers, two by the Allis-Chalmers Company, and the third by the Canadian Westinghouse Company. The power transformers are 20 kw. each and the lighting 15 kw. each.

The pumping motor is 20 h.p., 3 phase, 60 cycle, 720 r.p.m., made by Packard Electric Company, St. Catharines, Ont. There is a small panel board by the Monarch Electric Company, of St. Lambert, P. Q.

The main switchboard, controlling the power and lighting, is in the room containing the refrigeration plant. The board is fitted with Trumbull switches, and Economy and D & W fuses. Seventy-six circuits are controlled from the panel, the upper portion of which is equipped with Thomson type 1-9 induction meters, supplied by the C. G. E. Co. Two Crocker-Wheeler motors, each of 20 h.p., 550 volts, 3 phase, 60 cycle, 720 r.p.m., belt-connected to the compressors, are installed; there are also two Cutler-Hammer starters for starting the plant.

The lighting of the building is excellent. All the wiring is in conduit. On the verandah there are 56 14-in. Moonstone ball lights, Jefferson Glass Company, Toronto, and the interiors of the stalls are fitted with 100-watt tungsten enclosed in 10-in. Moonstone balls, with 60-watt lights for the cellars and stairs. The main space on the ground floor has 33 14-in. Moonstone ball lights, each of 150 watts, the interior of the shops being equipped with a total of 40 60-watt tungstens and 40 bracket lights.

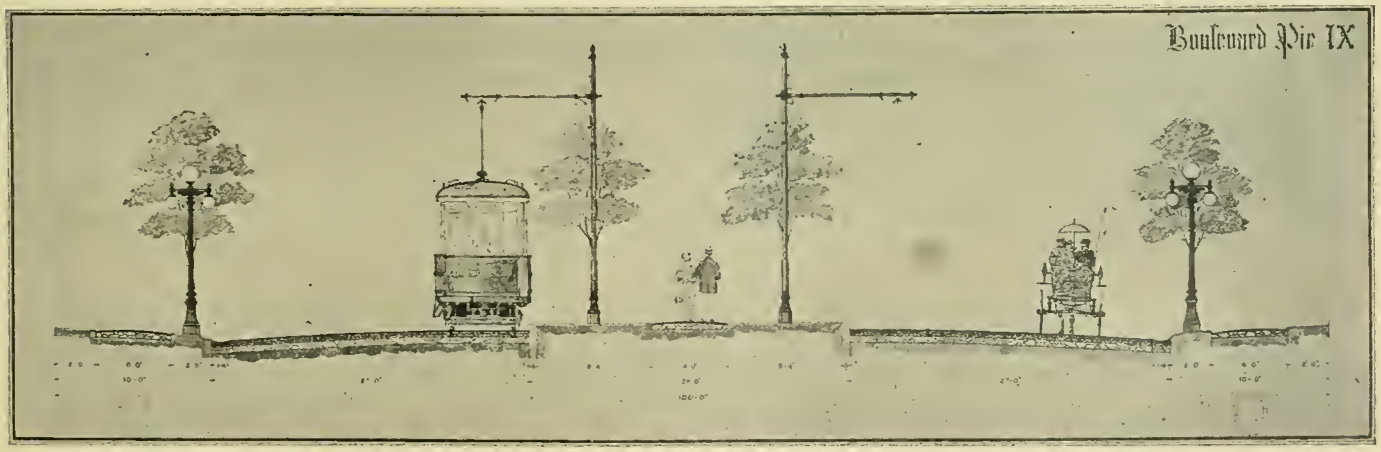
The next floor, used as a hall, is fitted with 65 Grecian lights, each of 100 watts. In the basement there are 16 12-in. Moonstone balls of 60 watts each. The building is surmounted by large towers and a dome (made chiefly of glass tile); enclosed on the towers are 16 16-in. Moonstone balls of 250 watts each, and on the dome 28 60-watt Moonstone balls. These are lighted at night, the light being reflected through the glass tiles.

In connection with the market, and on the Morgan Boulevard, a thoroughfare facing the market, a street lighting scheme has been carried out. The scheme is being continued on Pie IX. Ave., but in this instance the work is being done by day labor. The lighting is of the five cluster type, the top light being of 100 watts, and the remaining four, one at each corner, of 60 watts. They are enclosed in Moonstone spheres. The standards, of iron, were specially designed and supplied by the Cutter Company, South Bend, Ind. On the square in front of the market there are twelve standards, and eight similar standards are placed around the fountain in the centre of the square. Current for these lights is supplied from the basement of the market, the lead covered paper insulated cable being laid underground in conduits. The 34 standards on the Morgan Boulevard are spaced 100 feet apart on each side of the street, while on Pie IX. there will be eighty-eight standards spaced 125 feet apart.

The fire station and recorders' court, with cells for prisoners, is situated on Notre Dame Street East. The main entrance to the fire station and the side entrance on Letourneaux Street are lighted with 100-watt tungstens enclosed in artistic bronze lanterns. The dormitories, gymnasium, recorders' court, and the fire reel room are equipped with 22 5-light brass fixtures of 60 watts each, while there are 44 one-light ceiling fixtures in other parts of the building, in addition to 54 bracket lights of 60 watts each. All the wiring is in conduit. There is a small switchboard in the basement, fitted with D & W fuses.

The entire work for the street lighting, the market and fire station was carried out by the Canada Electric Company, Montreal, of which Mr. L. Rousseau is manager.

The Quebec Streams Commission have issued their third report covering operations up to November 1914. The report contains paragraphs under the following heads: St. Maurice River, Proposed Water Storage Lake St. Francis Basin, Report of Storage Possibilities in the Basin of Salmon River, L'Assomption River, Abitibi Region, Megiskan River, Bell River, Harricana River, Kinojevis River, Kewagama River, La Sarre River. The report is very fully illustrated.



Showing lighting standards and general plan of boulevards—Maisonneuve, P. Q.

Renfrew Joins the "White Way" Class

By A. G. Lang

The town of Renfrew on August 11th inaugurated a complete new system of street lighting which has proved to be a very successful installation and one that has given great satisfaction to the citizens generally.

This municipality is fortunate in owning a water power development which is situated within the town limits on the Bonnechere River, the power plant being only a few hundred yards from the centre of the business district. Power from this plant was already in use for certain municipal purposes and for supply to a number of factories in the vicinity of the plant, but there was a considerable excess of power and the installation of the street lighting is the first step in a general plan to make the power plant of maximum utility to the citizens.

Before the advent of the new system, the town was lighted by arc lamps; very inadequately, according to present day standards. The Hydro-electric Power Commission of Ontario was requested to take charge of the installation and the engineering department of the Commission designed the system and supervised the construction.

The retail stores, hotels and public buildings extend along both sides of Victoria Avenue, which is a wide, well paved thoroughfare and lends itself well to an ornamental system of lighting. On this street were placed cast iron standards of the Bishop's Crook type. These standards are of greater height and more imposing than those customarily used in "White Way" lighting, the overall height being 18 feet 6 inches. The lamp used is a 750 candlepower series 6.6 ampere nitrogen filled tungsten and the centre of the filament is held at 16 feet from the sidewalk.

The standards were placed 150 feet apart along each side of the street and staggered, and, as can be seen in the accompanying photograph, Fig. 1, the roadway is lighted with exceptional uniformity.

The current is carried by a single conductor, paper insulated, lead covered, steel taped armored cable which is laid in a trench made in the roadway beside the curb at a depth of 18 inches. The cables are terminated inside the standards in a combination pothead and absolute cutout,

Fig. 1.—Renfrew Whiteway, night view.

with a film cutout which breaks down when the lamp burns out and preserves the continuity of the circuit. Fig. 4 shows the type of standard installed on Victoria Avenue.

On account of the numerous trees it was considered advisable to light the residential streets with units of comparatively low candlepower and with close spacing and mounted on the pole low enough to clear the lower branches of the trees. The arc lamps used formerly were of little value on account of the trees. The new unit consists of a cast iron arm which supports a 12 inch globe, the centre of which is 12 feet from the ground. The leads from the line wire are brought down the side of the pole in conduit, Fig. 2. The lamp used here is a 150 candlepower nitrogen

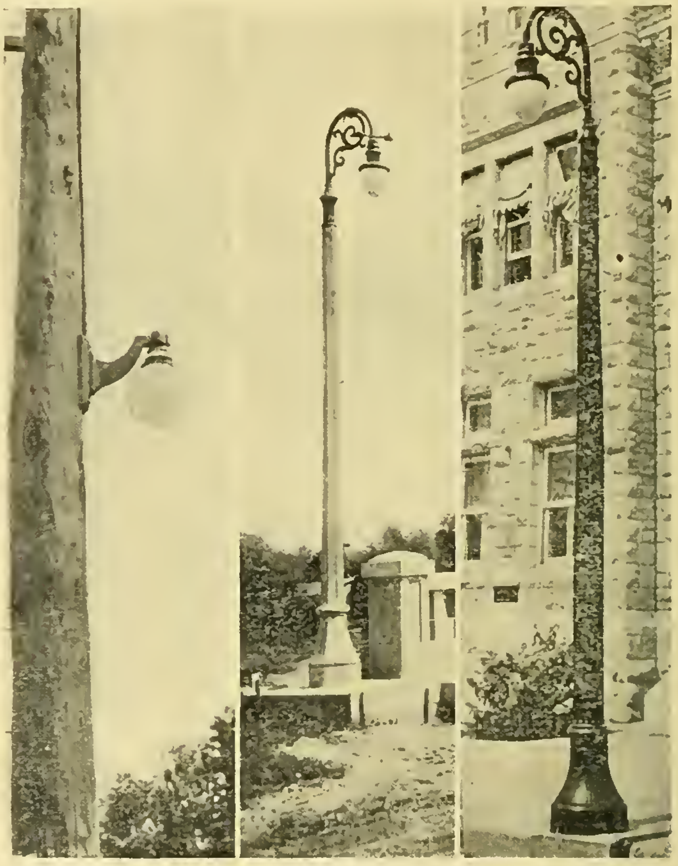


Fig. 2.—Residential street lamp. Fig. 3.—Special cement pole used at bridge. Fig. 4.—Main street standard.

filled tungsten. The glassware used both in the "White Way" and in the residential fixtures is a great improvement over what is commonly employed, being a new product known as "Monax." The lamp filament is completely obscured, although the absorption of light by the globe is less than 10 per cent.

The spacing of the lamps on the residential streets is varied according to the requirements of the various streets, being spaced usually at 200 feet, with 100 foot spacing on certain streets where traffic is heavier and in some cases at 100 feet and on both sides of the street. Fig. 3 shows a special concrete standard with pendant fixture which contains a 750 c.p. lamp. This standard is located beside a concrete bridge and in combination therewith presents a very pleasing appearance both by day and by night.

The system is divided into four circuits which are fed from constant current transformers. As the available space in the power house was limited, it was desirable to have the transformers occupy a minimum of floor space, and for this reason the type chosen was what is known as the double deck transformer. Two units of this type were installed. Each unit contains two primary and two secondary coils,

(Concluded on page 61.)

Lighting in Downtown Office Buildings

By Alfred O. Dicker and James J. Kirk*

The illuminating engineer is by nature attracted to the proposed building rather than to the older one which he passes in his every-day walks of life. He is desirous of having the lighting in the new building when completed typical of the best lighting practise, and in the age of "tear-down-the-old and build-a-new" he has found a large field. Nevertheless in the older buildings lies a much larger field of almost untouched harvest. In these, the older buildings, are thousands of workers toiling under lighting conditions typical of the first installations that were made. These lighting systems will soon be changed. They are so old now that either the wiring will be condemned by the various inspection departments, or else the tenants or owners will realize that for their own mercenary benefit more and better light must be provided for their employees.

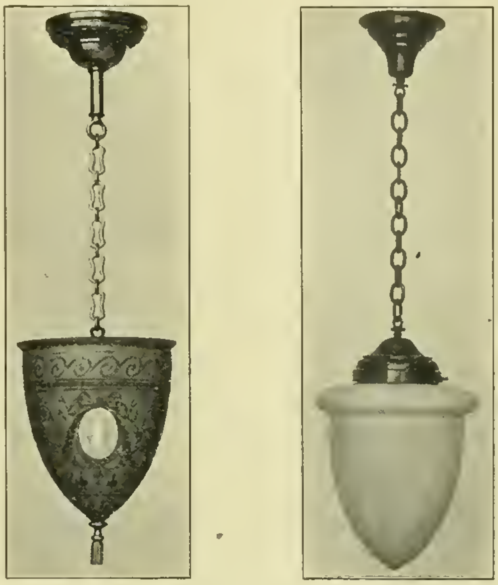
The lighting of thirty years ago is as absurd to-day as the business policies of that period applied to present-day business, and although it is sometimes difficult to convince the owners, they are just as much a source of real loss as the antiquated business systems. Proper lighting is now generally considered an essential part of factory equipment and an essential item in the reduction of manufacturing cost; but at present it is not generally accepted among business men as an item in reducing office costs. Data showing the reduction of office cost are difficult to obtain, but few engineers would dispute the statement that the working efficiency of a clerk or stenographer is reduced 25 per cent. after sundown in a poorly lighted office. This is the period of the day when the workers are tired and is therefore the period during which their comfort and efficiency should be considered.

One of the objects of this paper is to show the progress of lighting practise in downtown office buildings during the last thirty years, taking as examples buildings typical of the periods during which they were built. For this purpose six buildings were chosen as follows:

Building No. 1 built 30 years ago
Building No. 2 built 25 years ago
Building No. 3 built 20 years ago
Building No. 4 built 14 years ago
Building No. 5 built 6 years ago
Building No. 6 built 1 year ago

In all these buildings, even the most modern, are installations which the illuminating engineer would refuse to-day to accept as proper lighting; but nevertheless they are considered typical for the purpose of this paper.

It so happens that the oldest building chosen is one in which the owners had foresight enough at the time of its construction to wire for electricity. In the next two, in age, wiring was omitted at the time of construction but soon thereafter it was wired in exposed conduit or wooden moulding. In all three of these buildings the lighting is crude both from point of construction and resulting illumination. The installation has been made without thought or design—a drop cord installed over the desk or table where light was required. At this period electric light was expensive and the minimum amount was therefore utilized. A summary of the lighting of these three buildings shows little or nothing except as a comparative basis. The lighting is localized without reflectors in many cases and where reflectors are found a very cheap and inefficient one has been installed. The lighting is very inadequate. The original installation was of carbon lamps which have now been replaced with



Handsome designs for store or office—Jefferson Glass Co., Toronto.

* A paper presented at the ninth annual convention of the Illuminating Engineering Society, Washington, D.C., September 20-23, 1915.

TABLE I.—Description of Buildings.

					Lighting fixture				Wiring		
Bldg.	Age	Size in feet	Floor space (sq. ft.)	Height of bldg. floors (feet)	Suspension	Lamps per fixture	Lamp position	Type of lamp	System	Conduit	Moulding
1	2	3	4	5	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1	30	80 x 100	81,600	12	3.5 ft. stem	2	Vertical and angle	60-watt	Direct	Concealed	Exposed
2	25	80 x 115	110,400	12	3.5 ft. drop cord	1	Vertical	40 and 60-watt	Direct	Exposed	Exposed
3	20	190 x 141	340,000	17	3 ft. stem	3 and 4	Vertical	60-watt	Direct	Exposed and concealed	Exposed
4	14	120 x 144	204,000	17	3 ft. chain	1	Vertical	100-watt	Semi-direct	Concealed	None
5	6	52 x 110	95,000	18	Ceiling	4*	Vertical	60-watt	Indirect Semi-direct Direct	Concealed	None
6	1	96 x 163	106,836	18	Ceiling	1	Vertical	100-watt	Indirect Semi-direct Direct	Concealed	None

*This is not general practise but is an exception in a building of this class.

TABLE I.—DESCRIPTION OF BUILDINGS—(Continued)

					Typical office space					Typical corridor			
Bldg.	Age	Size in feet	Floor space (sq. ft.)	Height of bldg. floors (feet)	Size in feet	Ceiling height	Decoration walls and ceiling)	Professional or commercial	Size in feet	Spacing of units	Fixture	Hanging height	Exterior lighting
1	2	3	4	5	13	14	15	16	17	18	19	20	21
1	30	80 x 100	81,600	12	15 x 22	10′ 6″	Brown and white	Professional	6 x 100	21′	40-watt prism glass	Ceiling	None
2	25	80 x 115	110,400	12	20 x 30	10′	Cream and white	Commercial	6 x 60	15′	40-watt opal glass reflector	Ceiling	None
3	20	190 x 141	340,000	17	20 x 20	10′ 6″	Cream and white	Professional and commercial	8 x 500	21′	40-watt opal ball	Ceiling	None
4	14	120 x 144	204,000	17	20 x 20	10′ 6″	Cream and white	Commercial	12 x 36	18′	40-watt opal ball	Ceiling	None
5	6	52 x 110	95,000	18	15 x 25	10′ 6″	Cream and white	Commercial	8 x 80	21′ 6″	40-watt opal ball	Ceiling	None
6	1	96 x 163	106,836	18	18 x 33	11′ 6″*	Cream and white	Commercial	9 x 174	15′	40-watt prism glass	Ceiling	None

*This is not general practise but is an exception in a building of this class.

tungsten lamps, usually of 40 and 60-watt size. Cluster fixtures as a rule prevail—the most predominant type being a three or four-arm fixture suspended on a rigid stem installed approximately 6 ft. 6 in. (1.98 m.) above floor. Wall switches were used occasionally, but as a rule key-sockets have been utilized. The aesthetic considerations were not developed, but rather the lighting fixture was considered a necessary evil and not an ornament.

The next three buildings in chronological order show somewhat the effect of the illuminating engineer, at least it may be said that the lighting equipment has been given some attention. The fixtures are more efficient, more ornate, and general illumination has been introduced. The spacing shows a decided tendency away from localized lighting although in many of the offices, desk lamps have had to be relied upon. Particularly in these newer buildings the individual taste of the tenant as regards his lighting is evident, and so there are seen suites with semi-direct and indirect in all their variations.

The general building conditions are tabulated in Table I., which will answer at a glance many of the questions which might arise as to the details of the physical characteristics of the building and its lighting equipment. Its only value will be for purposes of comparison with Table II. and a description of the lighting fixtures used. A continued advancement in fixture design, the tendency toward larger lamps and the deviation from localized lighting toward general illumination is seen in columns 6 to 16, with the addition in the newer buildings of semi-direct and indirect. It would be well to add here that even in the oldest building there exist installations of semi-direct and direct but these do not occur in sufficient numbers to change the typical lighting system of the building. It must be remembered that these buildings were not selected as examples of good lighting, but rather as buildings containing lighting installations typical of the age in which they were built.

Table II. shows the total building light and power load together with such factors as influence the cost of such service. The connected load may be referred to Table I. for reference to the size of the building.

The load-factor[1] varies from 6.34 per cent., or 1.52 hours, to 17.48 per cent., or 4.2 hours use of maximum demand. The minimum may be explained by the fact that this building is one in which the lighting was installed after the building was completed and the installation was very inadequate. The maximum load-factor occurs in a newspaper building of such design that many of the lights burn of necessity most of the day.

The rates for electric service upon which is based the "average net bill per month" is as follows: the building owner buys the electric service for light and power either on a wholesale contract, if the building is of sufficient size, or

Table II-A.—Comparative Lighting Data

			Total building light and power				
Bldg.	Age	Connected load Kw.	Per cent. load factor	Av. Kw-h. per month	Av. max. per month	Av. net bill per month	Ratiomax. connected load per cent.
1	2	3	4	5	6	7	8
1	30	100.108	10.45	7,535.8	70.0	$ 388.37	70
2	25	159.210	6.34	7,212.9	63.3	357.52	39
3	20	380.124	7.35	20,062.7	232.4	1,008.75	61
4	14	877.823	17.48	110.486.4	424.2	2,347.20	48
5	6	199.089	13.03	18,241.1	134.4	745.47	67
6	1	342.790	6.38	15,978.7	96.0	610.82	28

on separate contracts for light and power. In either case in the buildings chosen for discussion in this paper the tenants are individual customers of the Commonwealth Edison Company. In the determination of the item of cost the ratio of maximum demand to connected load is a prominent factor and for this reason it is here included.

Table II-B.—Comparative Lighting Data

			Elevators and Public Lights				
Bldg.	Elevators	Connected load Kw.	Per cent. load-factor	Av.Kw-h. per month	Av. max. Kw. per month	Av. net bill per month	Ratio of max. to connected load
	9	10	11	12	13	14	15
1	5 hyd.	4.500	30.91	1,001.5	3.961	$ 40.74	88
2	2 elec.	78.250	8.25	4,626.0	50.700	183.74	64
3	12 elec.	41.472	17.42	5,201.5	16.165	185.23	38
4	8 hyd.	688.602	19.88	98,553.6	311,666	1,753.31	45
5	6 elec.	70.870	23.11	12,007.5	68.625	403.37	96
6	8 elec.	220.090	6.71	10,789.3	45.000	338.12	20

Similarly the second portion contains data on elevators and public lamps.

This table contains a separation of Table II-A showing the same data on that part of the total service which is used for elevators and public lights.[2]

The percentage of this portion of the electric consumption to the total building consumption is shown below:

Building	Per cent.
No. 1	13.3
No. 2	64.1
No. 3	25.9
No. 4[3]	89.1
No. 5	65.8
No. 6	67.5

or an average of 73.5 per cent. for all of the buildings (excluding No. 4).

1. Load factor, as used in this paper, may be described as follows: The ratio of actual monthly meter consumption (kw.h.) to continuous use of maximum demand, or

$$\frac{\text{Kw.h. (consumption)}}{720 \times \text{Kw.h. (maximum)}}$$

2. Public lights include all lighting contained in or around building which is not chargeable to tenants' meters, i.e., corridors, exterior lighting, toilets, etc. Elevators include all electricity used for power purposes.

3. This includes power for printing presses and is therefore not typical for this class of building.

Table II-C.—Comparative Lighting Data

			Offices				
Bldg.	Connected load Kw.	Load factor	No. offices occupied	Av. Kw-h. per office per month	Av. max. per office per month	Av. net bill per office per month	Ratio of max. to connected load
	16	17	18	19	20	21	22
1	73.748	6.76	88	40.6	0.632	$2.62	75
2	80.960	4.64	80	32.3	0.684	2.17	64
3	307,242	5.22	395	37.8	0.667	2.24	66
4	151.683	6.16	73	92.1	1.218	4.97	58
5	112.900	4.70	60	64.8	0.936	4.09	49
6	53.901	2.43	31	95.6	1.32	5.82	76

Here we have displayed the same conditions applied to the office or rentable area of the building. This portion represents 17.0 per cent. of the total building consumption. The tenant's load-factor is extremely low, showing a use of the demand of from one-half to one and one-half hours per day. The minimum load-factor occurs in the newest building. This is due to the fact that the building occupies a small land area with good exposure facing Lake Michigan, and it is higher than the surrounding buildings. The conditions make daytime burning of lights unnecessary in many of the offices.

Table II-D.—Comparative Lighting Data

			Store space			
Bldg.	Connected Load Kw.	Load-factor	Av. Kw-h. per month	Av. max. Kw. per month	Av. net bill per month	Ratio of max. to connected load per cent.
	23	24	25	26	27	28
1	21.860	18.78	2,955.7	10.4	$116.63	47
2	80.960	4.64	32.3	0.68	2.17	67
3	31.410	14.62	3,307.0	12.6	137.40	40
4	37.538	19.25	6,203.3	23.6	230.45	63
5	15.311	20.97	2,343.2	9.6	96.41	63
6	68.899	4.32	2,223.2	10.1	92.15	14

Inasmuch as the store and shop area on the first and second floors represent a load-factor of considerably higher value than the office space, a further separation has been made. In this table the load used by the store or shop is analyzed. This portion represents 9.5 per cent. of the total building consumption. It will be noted that the average load-factor of this portion of the building is 13.76 per cent. (3.3 hours) as against 4.99 per cent. (1.2 hours) for the office portion, and the ratio of maximum demand to connected load is 49.3 per cent. for this portion as against 73.3 per cent. for the office portion, which shows the store to be the longer-hour user, while the office uses a higher proportion of the connected load for a very short time, the former being by far the most desirable load from the central-station point of view. The fact that the office uses the lamps for such a short period is probably the reason that the office is the most dilatory to consider lighting improvement; but, as already stated, the time that the office requires light—short though it may be—is the very time that light is most essential.

Table II-E.—Comparative Lighting Data

Bldg.	Watts per sq. ft.	Intensity foot-candles	Cost of light per sq. ft. per month
1	29	30	31
1	1.02	1.5	$0.042
2	0.75	2.0	0.018
3	1.09	3.0	0.031
4	1.24	3.5	0.029
5	0.94	4.0	0.025
6	1.02	4.5	0.016

Table II-E sums up all the lighting data which have preceded. It will be noted that during the thirty years there has been little change in the watts per square foot provided, while the intensity has increased with each period and the cost per square foot has decreased. It must be borne in mind that the reason for the fact that the provided load has not increased during this thirty-year period is because the older buildings were not provided with what is to-day called sufficient illumination, together with the increased efficiency of illuminants. The standards of to-day are greatly in excess of those of previous years. These relations are shown graphically in curves 1 and 2.

Curve 1 shows the increased intensity of illumination with practically the same provided load.

Curve 2 shows the reduction in cost of electric light due to increased efficiency of illumination and fixtures. Curve 3 shows the reduction in cost due to increased efficiency of illuminant, fixtures and reduction in rates of lighting.

Table III.—Carbon Lamp

			Offices			
Bldg.	Connected load Kw.	Per cent. ratio of max. to connected load	Per cent. load-factor	Average Kw-h. per office per month	Average net bill per month per office	Cost in cents per sq. ft. per month
1	368.740	75.48	6.764	203.325	$13.12	3.975
2	404.800	67.18	4.64	161.650	10.86	1.810
3	1,536.210	66.282	5.223	189.400	11.24	2.810
4	758.415	58.607	6.162	460.915	24.89	6.220

Table III. shows data on the office portion of the first four buildings using carbon lamps as was the case when the lighting systems were installed. In this table the rating of the lamp is five watts per candle. The cost data are shown graphically on curve 3.

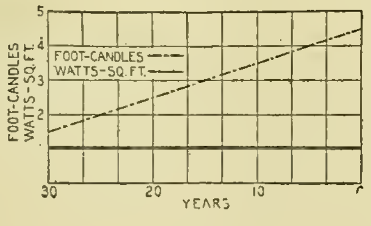
Renfrew Joins the White Way Class

(Continued from page 58)

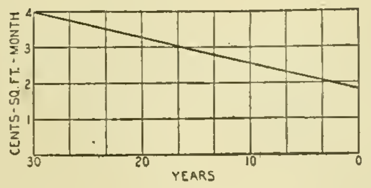
the primary and secondary coils of one circuit being mounted on the same frame directly above the primary and secondary coils of a second circuit.

Each of the four circuits is therefore independent of the others, each being controlled by an oil switch on the primary circuit and the ordinary plug switches on the secondary circuit. These switches with an ammeter for each circuit are mounted on two marble panels, each 90 inches by 24 inches which form an extension to the existing main switchboard.

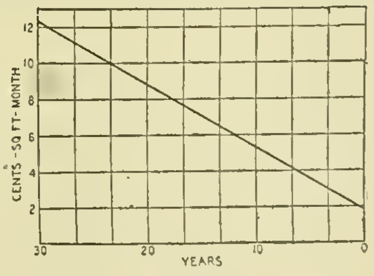
The connections between the switchboard and transformers and also the outgoing lines are carried in lead covered cables.



Curve 1.



Curve 2.



Curve 3.

Arc Lamps for Street Illumination

By C. A. B. Halvorson, Jr., S. C. Rogers and R. B. Hussey*

Streets in every city may be classified as follows in order of increasing importance: 1. Interurban highways; 2. Residential streets; 3. Boulevards and parks; 4. Secondary business streets; 5. Main business streets.

Interurban Highway Lighting

For the lighting of interurban highways where many miles of streets are to be considered and the expenditure of money per mile is necessarily low, the lamps must be spaced at considerable distances apart. Where the surface of the roadway affords a high degree of specular reflection such as an oiled road a sufficient intensity near the lamp is required for a reasonably uniform illumination and also a strong beam out at approximately 80 degs. from the vertical. Here the upward light is not of value and all possible use must be made of the specular reflection from the road surface. For such cases the pendant luminous arc lamp with a clear globe and band refractor gives excellent results. The arc itself gives a sufficient intensity near the lamp and the refractor redirects the upward light to the 80-deg. angle. These lamps should be suspended 25 ft. or more to obtain the best results.

In cases where the surface is rougher or such that no advantage can be taken of specular reflection, a high intensity at or near the 80-deg. angle is of less value and the pendant arc lamp suspended not too high, equipped with a diffusing globe and perhaps in addition an external reflector to utilize the upward light is a most satisfactory arrangement.

Residential Streets

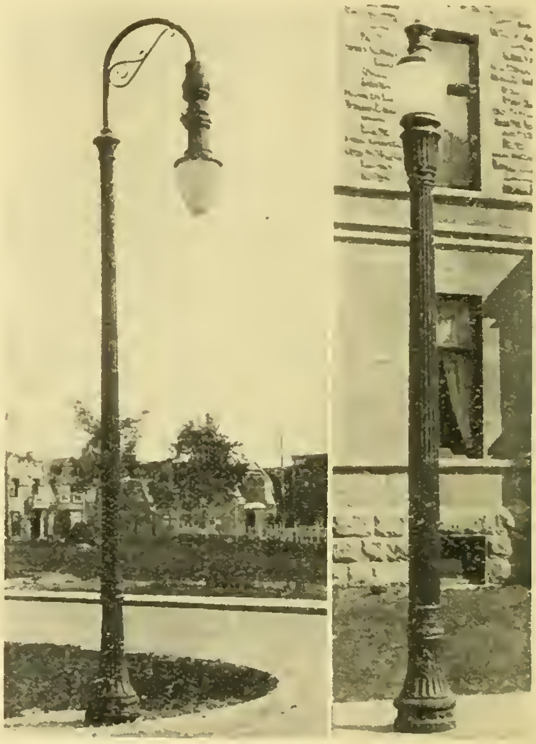
When considering these streets the conditions are somewhat different. Here the lamps must frequently be placed low on account of foliage, the intrinsic brilliancy must therefore not be too high and at the same time there must be sufficient illumination both on street and sidewalk to make travelling safe. Then too, some attention must be given to the design of the unit so that at all times it shall make a pleasing and harmonious appearance. For this work the ornamental luminous arc lamp with the Washington type (Fig. 1) or the later design of lantern or panel type equipment (Fig. 2) fulfills all these requirements, giving a soft, well diffused radiance without glare, and of a characteristic white color that not only enhances vision on street and sidewalk, but also on account of its low intrinsic brilliancy due to the large size of the globe and the use of glass of suitable density, the light emitted toward the houses is sometimes considered less objectionable and helps to render the entire street more attractive.

Fig. 1.

Fig. 2.

Boulevard or Park Lighting

Roads of this class are used by automobilists and pedestrians, hence the lighting should be suitable and adequate for each. These roads are frequently arranged with residences on one side and a promenade on the other and in such cases, lighting can best be accomplished by placing the lamps on the promenade side of the street only. In cases where there are two driveways with a reservation between, the best result may be attained by staggering the lamps on the edge of the reservation when it is wide, treating each drive separately or by placing them in the centre of the reservation when it is narrow.



Standards by John Watson & Son, Montreal, and installed in various Canadian towns.

The lamps best suited for this lighting are the ornamental luminous arc lamps mounted on 18-ft. standards or the pendant luminous arc lamps equipped with diffusing globe and external reflector and suspended from 20 to 25 ft. above the ground. When these lamps are used, with a spacing of 250 to 500 ft. (152.40 m.) depending largely on the character of the street surface, an intensity of illumination ample for all is obtained. The actual intensity, of course, will depend mostly on the electrode, current, and voltage of the lamps. The use of the ornamental luminous arc lamp with an external reflector, renders the natural scenic attractions visible at night and at the same time the dignified appearance of the unit as a whole harmonizes well with the surroundings though inconspicuous.

Secondary Business Streets

Secondary business streets are those that are mainly side

* Extract of paper read before recent Convention of the Illuminating Engineering Society.

streets and are lined with factories, warehouses, etc., and whose streets are not traversed by pedestrians at night to any great extent. The lighting of such streets as these, therefore, is primarily for police protection, and the pendant luminous arc lamp with diffusing globe with or without reflector and suspended at a height of 25 ft. (7.62 m.) is the best unit for this purpose. Also on these streets where there is practically no automobile traffic, these lamps can be adjusted for a minimum voltage and still furnish ample illumination on the street.

Main Business Streets

The main business streets of the city, namely, those whose stores are essentially retail and depend largely upon show windows for the display of their goods, merchandise or wares, must be lighted to satisfy all, the police, the motorist, the pedestrian or customer, and the merchant and also to bring out in relief the cornices, facades and other architectural effects, thereby creating a favorable impression upon visitors from other cities. This type of lighting is generally known as intensive or "white way" lighting.

In order to achieve the desired result of fairly intense and uniform lighting lamps of high candlepower must be employed, closely spaced averaging about 100 ft. (32.80 m.) apart on each side of the street. The ornamental luminous arc lamp is better suited for this purpose than any other form of illuminant since due to the high efficiency of the arc, a sufficient intensity of illumination on the street surface is obtained and makes possible the commercial utilization of upward light. The upward light in the angles adjacent to the horizontal are of utmost importance in the illumination of buildings on both sides of the street. Were this upward light to be wholly suppressed, a dismal and depressing effect would be produced upon the passer-by as a result of the unfinished effect caused by the sharp line of demarkation where the light leaves off and the dark shadow begins. This would be especially true were the light sources of this description themselves screened from view.

This class of lighting is not a fad for it is well known and highly advertised that trade increases with and follows intensive lighting. In other words, a merchant must have good show window lighting in order to obtain trade and attract the attention of prospective customers, but the best display of goods will be of little value if people are not drawn out upon the streets to see what he has to offer.

If a bright light be placed without a show window, the general effectiveness of the display is lost unless this light be of a different color and thus produce a contrast between the interior lighting and the street lighting. Where this contrast is present, the show window is attractive and distinctive, calling attention to the display within. This condition can now only be accomplished by the use of the ornamental luminous arc lamp where its pearl white light is in sharp contrast to the soft lighting of the show window itself.

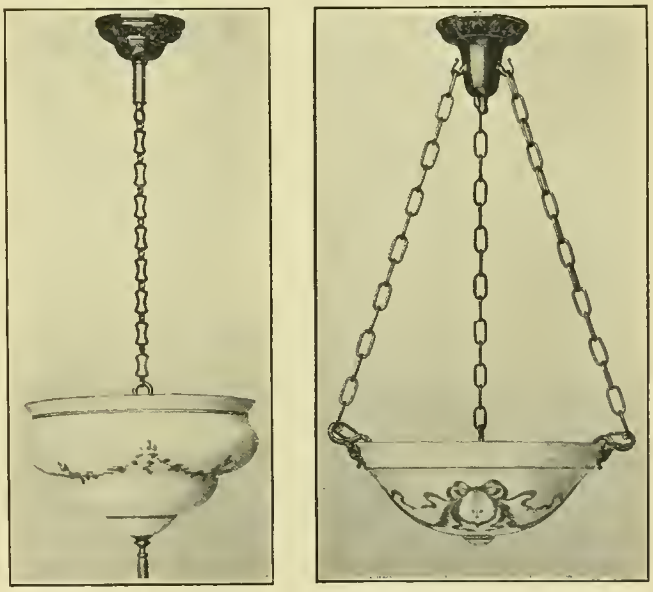
Montreal's Underground Work

At its last sitting in Montreal, the Quebec Public Utilities Commission heard further arguments on the question of providing separate manholes for signal companies and for lighting and power companies in the underground conduits being constructed for the city by the Electrical Commission. The main argument related to the interpretation of the following paragraphs in the City Code:—

"Separate openings or separate compartments in the openings shall be given to each company or person using the said conduits when asked for and provided the same is practicable. If the Electrical Commission of the City of Montreal should refuse separate openings to a person or company generally or in particular cases, an appeal shall lie to the Quebec Public Utilities Commission, which shall decide the question and determine who shall bear the costs."

"The conduits shall be so constructed that a permanent wall of brick or other non-conducting material shall separate completely and effectively that part of the conduits in which the electric light or power wires are placed from that part in which the telegraph, telephone, or signal wires are carried and the entrance to each part of the conduit shall be by separate manholes."

It was contended by Mr. Perron, K. C., for the Montreal Public Service Corporation, that the two paragraphs are to be read separately, and that as it was expressly provided in the charter that separate manholes are to be built for the signal companies, as distinct from the lighting and power companies, it was imperative that these should be constructed. On the other hand, Mr. A. Mailhiot, K. C., for the Electrical Commission, argued that the paragraphs are related to each other. By the charter separate manholes are to be built only when asked for; the companies had made no such requests, and consequently the conduits had been constructed without separate manholes. The Commission were willing at any time to construct them if they had been asked to do so, as provided in the charter.



Two types of Jefferson Glass Co's. semi-indirect glassware.

St. Hilaire to be Well Lighted

Eight tenders were submitted for the supply of equipment and installation of a 2200 volt transmission and distribution system for public and street lighting and for power for the municipality of St. Hilaire, P. Q. The bidding was very close, the contract being awarded to the Century Electric Company, 619 St. Paul Street West, Montreal. Power will be supplied by the Southern Canada Power Company, Limited, from a station just outside the limits of the municipality. The transmission line will be on 35-ft. wooden pols, except at railway crossings, where the poles will be 50 feet and 60 feet. Wooden cross arm construction will be employed. The series street lighting equipment will be controlled at a sub-station to be erected within the limits of St. Hilaire, and in which will be installed the constant current regulating transformer and the necessary panel. Eighty candle-power nitrogen tungstens will light the streets. Transformers for house lighting and power are to be mounted on the poles, lighting transformers to have grounded secondaries. The system will cover a distance of 3½ miles.

The Dealer and Contractor

Accidents and Good Lighting

Electrical contractors, particularly those specializing in factory, warehouse and kindred lighting, will be interested in an article printed elsewhere in this issue under the heading "Illumination and One Year's Accidents." This paper covers industrial accidents in the United States during 1914, where, it must be noted, conditions are decidedly more favorable on account of their more southerly location than they would be with us. It is fair to estimate that the number of accidents in Canada would, at the best, not be less than noted in this paper. The number is sufficiently appalling, however, 10,000 directly and 13,000 indirectly, traceable to improper lighting, to arrest the employer's attention. The facts may well be noted by electrical contractors as they constitute one of the most unanswerable arguments in favor of better lighting of industrial plants of every kind. An accident not only causes pain and possibly bereavement, but to the employer it means work delayed, a good workman lost, or laid off, and frequently financial obligations that would have paid for a proper lighting system many times over.

Co-operative Advertising

One of the most important topics discussed at the recent convention of Ontario electrical contractors was that of co-operative advertising. To just what extent this idea is being supported by the various members is not yet apparent, but there is little doubt that the suggestion is along right lines and, as such, is deserving of the support of all those who can possibly see their way to making a contribution to the "pot." One of the biggest business getters of the last year or two has been the electrical "page" as practised by contractors and dealers in a number of cities in the United States, being a whole page of one or more local papers given over entirely to electrical advertisements of dealers, contractors, central station, etc., supplemented where necessary by interesting information on electrical matters in general. The main advantages gained are: (1) a more or less fair division of financial expenditure, and (2) cumulative effects on the reader as a result of combination and co-operation of forces.

These, then, are the advantages that we may naturally expect would follow co-operative advertising by electrical contractors and dealers in any town or city. The public has got to be educated and this looks to be one of the best ways of going about it. Also, since it is a matter of education, pioneer work, in a sense, which cannot be expected to give big results immediately, it is all the more urgent and fair that everybody take a hand. Nobody in the electrical field wants, (or need hope) to belong to that class that gets something for nothing. Yet that is what might happen if only an occasional contractor advertises. His advertising is general; he describes the value of electrical toasters, for example, to the advantage of everyone who sells toasters. This is hardly fair. It is a work that all should join in. It is a work, too, that ought to be done without further delay. The public must be told—then they will buy. The sooner they are told the sooner they will buy.—Now then, "All together!"

Electrical Workers Receive Small Wage Cut

The inquiry into the wages and working conditions of electrical workers employed by the B. C. Electric Railway Company resulted in the conciliation board recommending reductions averaging about 3½ per cent., with several variations in the working agreement. Men working within city limits will be required to go to work on their own instead of the company's time. On short order work also, men acting as foremen will assist in the work if thought necessary by the company, but not in the capacity of an ordinary journeyman. Formerly foremen were required only to supervise the work. The new schedule of wages recommended follows:

	New Scale	Old Scale
Foremen	$4.90	$5.00
Journeymen	4.20	4.35
Repairmen	4.20	4.35
Cable splicers	5.10	5.35
Apprentices to begin	2.95	3.10
Apprentices after 6 months	3.10	3.25
Apprentices after 12 months	3.35	3.85
Apprentices after 18 months	3.70	3.85
Apprentices after 24 months	3.95	4.10
Apprentices after 36 months	4.20	4.35

The reduction will affect only a small percentage of the company's force of electrical workers, 112 of the men being employed under an agreement which has nearly two years to run. For this reason the company took no official part in the proceedings.

Catchy Window Advertising

A Toronto dealer hade a decided "hit" with a recent window display advertising a certain type of tungsten lamp. The centre of the display was a good sized field gun (about 5 cm. bore) mounted in the back of the window space on the moveable frame of an oscillating fan, so that the gun "swept" the observers on the street, back and forth. The fan was hidden from view by a cardboard covering made from two large cartons on which the name of the lamp was prominently shown. The surrounding background was obscured by curtains. The point of the display was further emphasized by catchy window-cards such as "——— lamps shoot light into the farthest corners of your room," and "——— lamps shoot your light bills full of holes." A number of perforated light bill forms were pasted on the window to add point to the latter statement. A few cartons and lamps in various sizes completed a display which was a decided feature of the week on that particular street.

Electrical Contractors meet in Stratford

A meeting of the Stratford Branch of the Electrical Dealers' and Contractors' Association of Ontario was held in the Oddfellows' Hall, Stratford, Ont., on Wednesday evening, September 22, at which there were in attendance dealers and contractors from several other cities in Western Ontario. Provincial president, J. W. Commeford, of Toronto, presided.

The meeting was called to order at 1.30 p.m. and an address of welcome delivered by His Worship Mayor Barnsdale of Stratford, who expressed his great satisfaction at the privilege of welcoming a meeting of the new Electrical Contractors' Association. His Worship tendered to the visitors the freedom of the city and expressed the hope that this trip would be only the first of a series to follow.

During the morning the visitors were entertained by the Stratford contractors to an automobile tour of the city. The session adjourned at 4.30 p.m. for a trip on the lake as guests of the Stratford section. During the afternoon the delegates visited the Stratford fair in a body.

Stratford is a progressive city of 18,000 population. The electrical contractors there have an agreement with the Public Utilities Commission whereby that body engages exclusively in the sale of energy, not touching installation work or the sale of materials or appliances. In addition, four of the contractors, who are also dealers, are privileged to maintain a showcase in the office of the Commission where various appliances are displayed with the names of the dealers handling same. A splendid feeling of co-operation between the Stratford contractors is apparent, much of which is due no doubt to their being brought together through the association.

Plans have been formulated for a co-operative advertising campaign in Stratford along educative lines, the cost of which it is expected will be borne by the Stratford dealers and contractors and the Public Utilities Commission of Stratford. Mr. R. H. Myers, secretary of the Public Utilities Commission, was present and expressed his hearty sympathy with the plans. It is understood that this campaign will be inaugurated by the Stratford members at once.

Considerable discussion took place on the subject of licensing electrical contractors and the following resolution was unanimously adopted: Resolved, that this meeting place itself on record as being heartily in favor of provincial license law for electrical contractors and that we heartily support the provincial executive in their efforts along these lines. And be it further resolved that the feeling of this meeting is that a license fee of $50 per annum would be in the best interests of all concerned and would protect the public against defective work installed by unqualified workmen.

The consensus of opinion was that there was pressing need for a provincial license law as local municipal license by-laws had proven unsatisfactory in a great many cases. Further, the feeling was that contractors should not be hampered in the scope of their operations. If there were local municipal by-laws to be met in every town and city it would mean that the contractor enjoying an extensive trade might require licenses in several municipalities.

Mr. Wills Maclachlan, Inspector for the Electrical Employers' Association of Toronto, addressed the meeting, outlining the activities of that association in accident prevention work. Mr. Maclachlan pointed out that every electrical employer included on the books of the Workmen's Compensation Board, under clause 38, is automatically a member of the Electrical Employers' Association and he also pointed out that the safety rules adopted by the association had been approved by the Lieutenant-Governor-in-Council and were now just as binding as the Act itself.

The subject of organization work was then taken up and representatives of the Provincial Executive present expressed their deep gratitude to the Stratford contractors for the enthusiasm they had shown in arranging this meeting. It was decided that if possible similar meetings would be arranged during the coming winter in different sections of the province to be attended by at least one member of the Provincial Executive.

The following members were in attendance at the Stratford Convention:—J. W. Commeford, Provincial president, Toronto; R. D. Earle, Provincial secretary, Toronto; E. A. Drury, Toronto; A. Wales, Toronto; W. J. Stewart, Stewart & Morkin, London; F. E. Garfat, Windsor; Ed. Mole, Seaforth; Robert Tait, Goderich; Wills Maclachlan, Toronto; Gilbert Campeau, Windsor; and M. D. Higgins, G. A. Drinkall, H. J. Peter, H. C. Whatmough, Wm. Bennington, S. K. Young, F. J. Sylvester, Stratford.

It is anticipated that a similar session will be arranged for Belleville in the near future.

Free Energy Premium in House-Wiring Campaign

In South Norwalk, Conn., a territory with a population of approximately 20,000 people, seventy-six old houses were wired and placed on existing lines of the United Electric Light & Water Company in two months as the result of an offer of free energy for a time.

The offer made by the company stated that three months' free electric lighting would be given to every old house that was wired and connected to the company's lines during the months of April and May. There was one condition. The house had to be on existing lines. The inducement did not hold if an extension was required.

The superintendent of the company, B. H. Gardner, gives interesting reasons for adopting the free-energy plan. "The desire in the breast of the average American to get something for nothing is very strong," he says, "and I thought that an offer of this kind would probably not cost us very much and would at the same time be quite an inducement to the customer. I think three months' free lighting would make more of an appeal to the average individual than an equivalent amount given in heating devices, and at the same time it costs real money, whereas a few extra kilowatt-hours would not cost anything in proportion to the value that the customer puts on it."—Electrical World.

Mr. Provost Unearths Some Museum Specimens

The wiring of the "Seminaire de St. Hyacinthe" has just been completed by Mr. I. E. Provost. This is an installation of conduit and metal molding requiring the use of 33,000 lineal feet of conduit and molding and 102,000 feet of wire. Further equipment installed includes 20 panels, a switchboard, 1200 lights, 590 switches, and so on, for service in 287 rooms and passages. This building was wired some twenty-six years ago and the old equipment that has been replaced is worthy of a prominent position in our best museums. A comparison of the equipment furnishes striking evidence of the progress that has been made in the electrical manufacturing and contracting business in the last quarter of a century.

License Laws for Electrical Contractors

Mr. Whatmough's paper read before the recent Ontario electrical contractors' convention on the subject of licensing electrical contractors, opens up for discussion a question that is at the present time absorbing the attention of electrical contractors all over Canada and the United States.

The primary flaw in the Stratford license scheme is that it is purely local. This can be, and we have no doubt will be remedied, if the contractors stand together, by a general ordinance covering the whole of the province under the supervision of the present provincial inspection department of the Hydro-electric Power Commission of Ontario. The first requirement of such a law will naturally be that every man engaged in the practical side of electrical contracting must show himself competent for the work he claims to be able to perform. The second requirement is a license fee for all master contractors of sufficient size to give protection, yet not too big to kill any deserving contractor who might be doing business in a small way only. Whether or not a guarantee bond from the contractor should also be demanded is open for discussion.

As intimated above, this question is also being widely discussed in the United States, where results have already made their appearance. The National Electrical Contractor, the official organ of the National Electrical Contractors' Association of the United States has at various times discussed this subject, and in their September issue print in detail an electrical ordinance recently put into force in the city of St. Louis; also a law re licensing electrical contractors in the state of Massachusetts; also a part of the New York City ordinance. Extracts from these reports are printed herewith in the hope that our own contractors may pick out some suggestions that will assist them in framing a recommendation to suit their own particular needs.

Massachusetts Law to License Electrical Contractors

The State of Massachusetts recently passed a general act to license electrical contractors and electricians. The law is in part as follows:—

I.—Except as hereinafter provided, no person, firm or corporation shall, after the first day of September, nineteen hundred and fifteen, enter into, engage in, or work at the business of installing wires, conduits, apparatus, fixtures or other appliances for carrying or using electricity for light, heat or power purposes in this commonwealth, either as a master or employing electrician or as a journeyman electrician, unless such person, firm, or corporation shall have received a license or certificate therefor, issued by the board provided for in section two of this act and in accordance with the provision hereinafter set forth.

The words "master or employing electrician" as used in this act shall mean a corporation, firm or person, having a regular place of business, who, by the employment of journeymen, performs the work of installing wires, conduits, apparatus, fixtures and other appliances for carrying or using electricity for light, heat or power purposes.

The word "journeyman" as used in this act shall mean a person who does any work of installing wires, conduits, apparatus, fixtures and other appliances for hire.

II.—On and after the first day of July, in the year nineteen hundred and fifteen, the chairman of the civil service commission, the fire prevention commissioner for the metropolitan district and the commissioner of education shall constitute the state examiners of electricians. They shall employ as clerk a practical electrician, who is a wage earner, and a citizen of the commonwealth, who has had at least ten years' experience in the installation of wires and appliances for carrying electricity for light, heat or power purposes. He shall receive such salary as shall be determined by the state examiners, subject to the approval of the governor and council, and shall hold his office for a term of three years. The three examiners shall receive no compensation for their services under the terms of this act. The compensation of the clerk and the travelling and other necessary expenses of the state examiners, not however to exceed five hundred dollars in the aggregate for each of the members thereof, shall, when approved by the governor and council, be paid from the treasury of the commonwealth.

The state examiners of electricians may make necessary rules for the proper performance of their duties.

They shall hold frequent examinations in the city of Boston, and, twice in each year, shall hold examinations in at least five other convenient places within the commonwealth, and they may hold annual or occasional examinations in other places. Public notice shall be given of all examinations.

The state examiners of electricians shall annually, on or before the first Wednesday in January, transmit to the secretary of the commonwealth a report to the general court of its doings.

In the conduct of the examinations they shall make uniform requirements for all cities and towns, which may be revised from time to time, as circumstances may require. Said examinations shall be sufficiently frequent to give ample opportunity for all applicants to be thoroughly and carefully examined, and may be supervised by one or more of the members of the board, but no licenses shall be granted without the sanction of the board. Examinations may be given in writing or practical work, as deemed most advisable by the board.

III.—(1) Two forms of licenses shall be issued. The first hereinafter referred to as "certificate A," shall be known as "master electrician's certificate," the second, hereinafter referred to as "certificate B," shall be known as "journeyman electrician's certificate."

A "master's certificate" shall be issued to any person, firm or corporation engaged in or about to engage in the business of installing electrical wires, conduits, apparatus, fixtures and other electrical appliances, that shall have qualified under the provisions of this act. A certificate of registration shall be issued specifying the name of the person, firm or corporation so applying, and the name of the person passing said examination, by which he or it shall be authorized to enter upon or engage in business as set forth therein: provided, however, that any person, firm or corporation that has been engaged in said business for at least five years next prior to the date of the application shall not be required to pass said examination, but shall present proof of fitness.

The holding of "certificate A" shall not entitle the holder individually to engage in or perform the actual work of installing electric wires, conduits and appliances as previously described in this act, but shall entitle him to conduct business as an employing or master electrician.

(2) "Certificate B," or a journeyman electrician's license, shall be granted to any person who has passed an examination before the examining board provided for in this act, or who shall present proof of fitness and that he has gained his livelihood by the occupation of electrician for five consecutive years next prior to the date of application. A certificate shall be issued specifying the name of the person so engaged, by which certificate such person shall be authorized

to enter upon or engage in the occupation of journeyman electrician. Every person desiring an examination shall make application therefor in writing accompanied by the proper fee. The fee for an examination for certificate "A" shall be twenty-five dollars and that for certificate "B" shall be one dollar. An applicant who fails in his examination shall not have his fee returned to him but shall be entitled to one re-examination free of charge. For each subsequent re-examination, he shall pay fifteen dollars in the case of certificate "A" and fifty cents in the case of certificate "B."

(3) All certificates "A" described in paragraph (1) of this section shall expire on the thirty-first day of July in each year, but may be renewed by the same person, firm or corporation, as represented by one or more of its members or officers, without further examination, upon the payment of a fee of fifteen dollars, application therefor being made during the month next prior to said expiration of said certificate.

(4) All certificates "B" described in paragraph (2) of this section shall expire on the thirty-first day of July in each year, but may be renewed upon the payment of a fee of fifty cents, and upon the same conditions set forth in paragraph (3) of this section.

(5) All holders of certificates "A" shall keep their certificate of registration displayed in a conspicuous place in their principal offices or places of business, and all holders of certificates "B" shall be furnished by said board with evidence of their having been so licensed, in card form or otherwise, which shall be carried on the person of the licensee and exhibited on request.

IV.—No certificates issued under the provisions of this act, to either master or journeyman, shall be assignable or transferable. Said certificates may be suspended or revoked by the board of examiners upon failure or refusal of the licensee to comply with the rules and requirements of said business as set forth by the board of gas and electric light commissioners, and for other and sufficient causes after a hearing has been held. Such suspension or revocation by said board shall be subject to review by the board of gas and electric light commissioners.

V.—Any person, firm or corporation, or employee thereof, and any representative, or any member or officer of such firm or corporation individually entering upon or engaging in the business and work hereinbefore defined, without having compiled with the provisions of this act, shall be punished by a fine of not less than ten dollars nor more than one hundred dollars for the first offence, and for a second offence by a fine of not less than fifty nor more than five hundred dollars, or by six months' imprisonment in the house of correction, or by both such fine and imprisonment.

VI.—No person, firm or corporation holding a master's certificate shall be held liable for work done by any of his or its employees without authorization, unless it shall appear that such work was done with his or its knowledge or consent or by his or its authorization.

All fees and fines collected under the provisions of this act shall be paid into the treasury of the commonwealth as hereinbefore provided.

VII.—This act shall not apply to the installation, repairing and wiring of elevators or to work in connection with the erection, construction, maintenance or repair of lines for the transmission of electricity from the source of supply to the service switch on the premises where it is used by municipal electric plants, by electric companies as defined in section one of chapter seven hundred and forty-two of the acts of the year nineteen hundred and fourteen, or by gas companies authorized to engage in the business of making or selling electricity, by electric street railway companies or by electric railroad companies or by railroad companies; nor to the work of such plants or companies on premises owned or controlled by them; nor to the work of said municipal electric plants or of said electric or gas companies in installing, maintaining and repairing, on the premises of customers, service connections and meters and other apparatus and appliances which remain the property of such plants or companies after installation; nor to work in connection with the lighting of streets, alleys, private ways or private or public parks, areas or squares; nor to the work of companies incorporated for the transmission of intelligence by electricity in installing, maintaining or repairing wires, apparatus, fixtures or other appliances used in the business of such companies and necessary for or incident to such business, and whether such wires, conduits, apparatus, fixtures or other appliances are on its own premises or otherwise.

VIII.—Nothing in this act shall be construed as forbidding the employment of learners or apprentices working with and under the direct personal supervision of journeymen electricians duly certified as provided in this act.

Electricians employed by theatrical companies may install such temporary wiring and appliances as may be required for the purpose of the engagement of any such company, subject to the supervision of some person licensed under the provision of this act.

Electricians regularly employed by firms or corporations other than holders of class "A" certificates may install such electrical wiring, conduits and appliances or make such repairs as may be required only on the premises and property of said firms or corporations: provided, that said electricians hold a journeyman's license and have compiled with all provisions set forth in this act.

Extracts from the New York City Electrical Ordinance

The Board of Aldermen of the city of New York, under date of July 6th, passed an ordinance which provides for the licensing of electrical contractors by the Commissioner of Water Supply, Gas and Electricity. Exemption from the provisions applies to electrical equipment in buildings under the control of the United States Government and to the following described electrical equipment used in connection with lighting and power companies: (a) Generating stations, (b) sub-stations, (c) storage battery stations, (d) storage buildings and yards, and (e) service switches and controlling devices and meters and their attached controlling and testing devices; provided that the electrical equipment hereinabove referred to be owned or leased and operated by, or for the exclusive benefit of, persons or corporations, subject to the jurisdiction of either of the public service commissions of the State of New York, or their successors.

The general scope of the law is told in the following extracts:

"No person shall install, alter or repair electric wiring or appliances for light, heat or power in any building except a person holding a license, a special license or a special permit as defined in No. 1 of this chapter, or a person employed by and working under the general supervision of the holder of a license, a special license or a special permit, and after application for a certificate of inspection of such installation, alteration or repair. A license or a special license shall remain in force for one year from the date of issue, and a special permit shall remain in force during the performance of the work which it authorizes, unless modified, suspended or revoked, as hereinafter provided; but in no case shall a special permit remain in force for more than one year.

"The commissioner may at any time, by an order in writing, for good cause shown, modify, suspend or revoke any special permit issued pursuant to this chapter, and in like manner, but upon recommendation of the license board,

he may modify, suspend or revoke any license similarly issued.

"All applications for licenses, special licenses, special permits or certificates of inspection shall be made to the commissioner in such form and detail as he may from time to time prescribe. A license, special license or special permit shall not be transferable.

"The commissioner shall appoint a board to determine the fitness of applicants for license, which shall consist of:

"a. An officer or employee of the department of water supply, gas and electricity;

"b. A master or employing electrician;

"c. A journeyman electrician;

"d. An underwriters' electrical inspector;

"e. An electrician in the employ of a public service corporation of the city;

"f. An architect or builder of at least five years' practical experience;

"g. A real estate owner or broker.

"All applications for licenses or special licenses shall be referred by the commissioner to the board, which shall promptly investigate and report to the commissioner as to the fitness for license of the respective applicants. The board shall meet at least once in every week for the consideration of such applications. The board shall investigate and report to the commissioner respecting any change that may be made against the holder of a license or a special license.

"There shall be charged and collected by the commissioner a fee of $10.00 for each license issued under the provision of this chapter and thereafter an annual fee of $5.00 for each renewal of such license and a fee of $1.00 for each special license or special permit so issued."

The St. Louis Ordinance

The St. Louis ordinance deals chiefly with the appointment of a chief inspector and assistants and the rules which shall govern inspection. The following paragraphs deal with licensing:—

The Director of Public Utilities is authorized to receive, investigate and record applications for licenses from individuals, firms and corporations to engage in or work at the business of installing, erecting, altering, supervising or service inspection of electrical material, wiring, fixtures, machinery or apparatus for the generation, transmission or utilization of electricity for light, heat or power within or about any building in the city of St. Louis, and if he finds the applicant competent and qualified to carry on such business he shall issue an annual license to such person, firm or corporation upon the payment of an annual fee of ten dollars ($10.00). He shall also receive applications from individuals, firms or corporations having in their regular employ a maintenance electrician, to make or supervise repairs or alterations on their own premises, and shall issue a certificate of authority to the License Commissioner, who shall issue an annual maintenance certificate to such person, firm or corporation upon the payment of an annual fee of one dollar ($1.00).

Every person, firm or corporation before entering into the business of installing, erecting or altering of electrical material, wiring fixtures, machinery or apparatus for the generation, transmission or utilization of electricity for light, heat or power within or about any building in the city of St. Louis (excepting electric light and power companies operating under city franchise and railway companies doing work on their own equipment in or about their plants; telephone or telegraph companies installing their own equipments) and employers working under the instruction of a person, firm or corporation licensed under this ordinance, shall make written application to and obtain from the Director of Public Utilities a license to engage in such business.

Bond.—No person, firm or corporation shall engage in the business of installing, erecting, altering or service inspection of electric wiring, fixtures or apparatus in the city of St. Louis (except public lighting, telephone, telegraph and railway plants or exchanges), and employees working under the instruction of a person, firm or corporation licensed under this ordinance, before furnishing bond to the city of St. Louis in the sum of one thousand ($1,000.00) dollars, conditioned that they or he will faithfully observe all ordinances of the city and the rules and regulations adopted in accordance with the provisions of this ordinance.

The Spirit of Co-operation

By George W. Hill*

At no very remote date, the men in the electrical industry were all out for each other's scalps. Every man for himself, he thought no one else was playing the game fairly, believed everyone else guilty of price cutting and doing poor work, considered the other fellow unfit to be in business and there was the devil to pay all around. Such conditions did not tend to develop the industry; neither were they conducive to the welfare of the men engaged in it.

During the past few years, the spirit of co-operation has entered into our hearts; the real men of the industry, the live ones, the men who are and who are going to be successful, have recognized the necessity of working together for the good of all and at the same time for the good of the community in which they live and move and have their being. It is that spirit which has made possible the Society for Electrical Development. It is that spirit which led you to invite me here to address you today.

A new point of view has been reached. Up to the present, most of the talk and effort has been to determine how the central station could help the dealer and contractor. Now the latter interests have come to the front in a movement through which they are going to try and find out what they can do to help themselves and incidentally the central station.

It seems to me that this is a most vital point of view and one that has the most hopeful inspiration in it of any that has come to our attention in some time. It means much. Every central station manager and every central station employee who is succeeding in his work has to keep keyed up to the highest point of sensitiveness in his relations with the public. He makes it a point everywhere to put himself out and to please in every possible way, for the sake of the goodwill that will be left behind. Every central station representative realizes that "a pleased customer means ten." No matter how big the advertising department of a central station may be, no matter how much money they spend in goodwill advertising and circularizing and contributions to the various public charities, etc., they cannot, no matter how lavish they may be, offset a careless or neglectful manner, or a toploftiness on the part of the representative of the company.

That is all very well so far as it goes, but central station men cannot be everywhere and they cannot be in several places at the same time. In other words, they cannot

*Representing Society for Electrical Development, before recent convention of Ontario electrical contractors.

put themselves in the places of the other electrical interests. An electrical contractor has a peculiarly intimate relationship with people who will be, as soon as they pass out of his hands, customers of the public lighting company. This contractor and his employees working in a house or a building anywhere, come in contact with great numbers of other workmen, which is very important, and what is still more important, come in contact very closely with the owner of the property and occasionally with the contractor who may be erecting the building, if it is a new one.

Contractor vs Central Station

Here, then, is the first place where the electrical contractor and the central station can co-operate. He should understand their methods and be in sympathy with their policies and work with them. It stands to reason that he can be in sympathy with the central station. He is frequently a small dealer who does business on a small scale. His investments are comparatively small and his risks are in proportion. The central station has a large investment, is meeting people not only as individuals, but as organizations and in city and town governments, and must adjust its policies not only to please the people but to give the best service and consequently get a satisfactory return on its investment. It is reasonable, therefore, that the central station should aid in determining the policies under which the business is to be carried on and it stands to reason that all should agree to standardized co-operation.

The next important step is not only to agree to this policy and follow it, but talk about it. It cannot be said in the electric light business that "every knock is a boost," because a central station man or people friendly to the central station interests cannot always be around to explain the various conditions in connection with the knock, and thereby turn it into a boost. Therefore, the second big point is, not only don't knock, but boost and boost actively. Every electrical contractor has his own circle of hundreds of acquaintances and friends, his own field, large or small, where he does business and where his word on electrical matters is taken as authority. In these fields he should be active to talk in the interest of electricity, of himself and of the central station. The public should be made to realize the importance of electricity in their daily lives.

Third, the committees that have been appointed to work jointly for the advancement of standardized co-operation might very well lay out a scheme for co-operative effort throughout their territories,—taking some one subject each month and every man agreeing to talk favorably on that subject. The committees could send out printed matter explaining the subject that was under consideration each month, pointing out ways in which it could be brought more definitely to the peoples' minds. This subject need not have to be a bargain sale in flatirons or percolators or lamps; it can be simply the consideration of some one policy that is common to all the companies and can therefore be talked about freely all over the country. Take for instance, the question of merchandising, the policy regarding the wiring of existing houses, the matter of requiring deposits from new customers, the question of taking applications by telephone, the question of how the peaks or discontinuances and new connections should be handled on moving days which happen to come about the first of May. There is a big peak load that must be taken care of, but it means a tremendous unusual expenditure and perhaps some way can be devised for spreading out that work. The consideration of such problems as these and the discussion of them here and there will certainly bring the contractors and the central station men not only closer together but closer to the people, and there will be a fuller, freer understanding of the problems that keep coming up.

A great deal of what I have said so far to-day was read at the joint meeting of the Electrical Contractors' Association of Massachusetts and the New England Section of the National Electric Light Association, by Mr. L. D. Gibbs, the president of the latter association. A similar movement to your own is under way in New England, and indeed, in all the live electrical centres of the United States.

A very important and practical way to co-operate is by stimulating the sales of appliances. This is probably the most difficult field to reach because there are so many different opinions and the financial and various business conditions of the dealers and contractors are as different as the men themselves. It should, however, be quite possible to determine a definite policy or policies that could be followed.

One way in which the Society for Electrical Development has helped to bring about co-operation between the contractors, the dealers and the central stations, has been by encouraging the "Electrical Page" in the daily newspapers. In over thirty cities to-day Electrical Pages are running once a week; the central station, the dealers, and the contractors are carrying advertisements in them and the Society is co-operating by supplying the newspaper every week with new items of interest, to be published in the Electrical Page, thus making it attractive, interesting and readable for the public.

In several cities in the United States arrangements have been made between the contractor and the central station, whereby the former does all the wiring at prices previously agreed upon. The central station pays the contractor's bill, less 10 per cent., when the inspector and the customer have passed upon the work as O. K. and the central station collects it from the consumer in monthly instalments. This has been found to work out very satisfactorily. The 10 per cent. is, of course, added to the original estimate in consideration of the deferred payments.

Price Cutting

A common practice in the past among electrical contractors whose business was not any too firmly established, was, when bidding on a job of electrical installation, to cut the price to any figure for which any other contractor could be induced to take it. Indeed, the cutting sometimes went even below this mark, where misrepresentation led to the belief that it was a question of cutting the price or losing the contract. The organization of electrical contractors and the wider dissemination of knowledge concerning correct methods of figuring costs is gradually rendering this condition obsolete, but much yet remains to be done. The contractor is learning that co-operation with his fellows is more to his advantage than cut-throat competition.

The prosperity of the contractor and the interests of the building owner in securing first class work can only be promoted by an abstinence from price cutting, an insistence upon keeping bids above estimated costs, and the separation of contracts for electrical work from the general contracts for building construction. Only through co-operation can the contractors secure these conditions.

Central station men and contractors appreciate the desirability of getting together, but a good many meetings fail to accomplish anything constructive because there is insufficient discussion of real problems. Why not have a meeting of this kind at which every central station man and every contractor with a grievance will send in a brief anonymous statement of his troubles to a small committee in charge of the discussion, throwing these specific charges open for attack and defense without attaching names or places? In this way no local central station man could feel that the contractor was trying to discredit him at the meeting by criticism, and the same thing would apply to the contractor.

Let a small contractor, for instance, send in a brief statement bearing upon the troubles he encountered be-

cause the local lighting company undersold him in appliances in a three week campaign, and let the floor be open for a frank discussion of the pros and cons of this policy.—a whole lot of good give and take is bound to follow.

He who consistently and conscientiously strives to raise the standard of electrical material in its design and manufacture; he who brings about a more rigid specification, inspection and enforcement of it, is decidedly your friend, unless it is your aim to secure your business by price methods, then you will always find someone willing to go you one better in the race of price cutting, unhealthy competition; the temptation to cheapen everything becomes irresistible and things are on the toboggan.

Central stations acknowledge that their prime responsibility is in the sale of energy and it should be recognized that when they involve themselves in the sale of current-consuming devices, they do so generally in the belief that the dealers in such devices are not in a position or, at any rate, have not proven their ability to render this service for them. They realize that the other branches of the industry can assist them in increasing their load factors and generally speaking are willing to meet the contractors and dealers in a co-operative spirit. This leads to the encouragement of the contractor and dealer to establish representative retail stores, from which the consumer can readily be served.

I do not believe that there is a central station but would much prefer to confine its business entirely to the generating and selling of current, but these people have gone into the other activities simply because there was no one else to take them up efficiently at the time. Merchandising is not like engineering. Local conditions vary so greatly that it is impossible to lay down hard and fast rules for all to abide by, everywhere, but there are certain fundamental principles upon which all can agree and which all can live up to. Committees should get together at regular stated intervals. The principles of good sound merchandising should be set forth and standardized. Let us all co-operate in this movement, let the co-operation be real and efficient—that in itself will make it grow in its force and effectiveness.

The prize of success will ultimately go to the man who learns best how to co-operate with his fellow man and with the public, whose interest it is your interest to serve efficiently.

Do It Electrically

By Walter Carr*

This subject you have given me is so broad and the arguments that may be advanced in its favor are so numerous that one can only attempt on an occasion like the present to cover a very small section of the total area. And as, probably, a larger percentage of those present are more interested in the application of electricity in the home than in any other part of the field for which electricity is now recognized as being specially adapted, I have thought best to confine myself to that corner of the field which deals particularly with doing things electrically and making it possible to do them electrically in private residences.

The average citizen doubtless under-estimates the important part that home life plays in his business career. Most men spend from one-half to two-thirds of their time in their own homes; women spend, often, all their time. If the conditions under which the home life is lived are less favorable than they might be; if the daily work of the woman is made so arduous that her hours of rest and recreation are too few; if the best facilities for recuperation for the next day's work (both of body and mind) are denied the breadwinners, their daily work goes forward with less success. It is because electricity in the home is such a tremendous aid towards this greater efficiency and is capable of playing so important a part, not only in the home itself, but, indirectly, in the office, the factory and many other fields of labor, that this appeals to the writer as being probably the most important application of all those for which this wonderful source of energy has shown its adaptability.

Doubtless it can be taken for granted that everyone here is as enthusiastically confident in the value of doing things electrically in the home as I am myself. Possibly some of you will say, however, that you are in a better position to appreciate the obstacles in the way. That may be, but you must always concede to an onlooker, if he understands conditions at all, the ability to form more or less impartial and, therefore, more or less useful, opinions. The obstacles in the way of a more general use of electricity and of electrical devices in the home seem to me to fall under two general heads. It is of these and of the influence the electrical contractor and the electrical dealer are often in a position to exert to overcome these obstacles that I will speak briefly to-night.

The two main obstacles to the more general use of electrical devices seem to be:—

1. The householder doesn't want them because he doesn't know their value.
2. He can't use them because his home is not properly equipped.

Householder Doesn't Know

The average lay man or woman doesn't appreciate that the general use of electricity in the home means greater comfort, longer hours of recreation, more healthful surroundings, and so on and on—improved factors that one may outline almost without number. How should they? The farmers' antagonistic attitude towards the telephone for so many years is an exactly similar case and yet one of those farmers who had been most sceptical about the value of a telephone to him, and one of the last to hold out against it, said to me the other day that he had saved the yearly cost of the telephone recently in selling one load of peas. He did, it is true, complain that it was very expensive—$8.00 a year. Now, this is one of the most gratifying and wonderful things about the use of electricity in any form—nobody who tries it ever can afford or will consent to give it up. That places the electrical contractor and dealer in an entirely different class from the ordinary salesman or solicitor who often has to try to sell a customer something that he not only does not want, but does not need—and never will want or need. You, by diplomacy, coercion or what not, may induce a man to improve or increase his wiring facilities or buy more utensils and you will always have the firm assurance that, as time goes on, this customer will be a better friend to you because he will appreciate more every day that you were working in his interests, though he possibly may not have seen it at the time.

A very necessary part of our campaign then must be that of educating the public to appreciate the value of what we have to offer. How is this to be accomplished? Plainly, by demonstrations, exhibitions, window displays, newspaper

*Extracted from paper read before the recent Ontario Electrical Contractors' Convention.

advertisements, co-operation with general contractors, architects, etc.

Best Methods of Educating Public

In this connection we must not forget to give due credit to certain of those organizations which do not all the time appeal to the electrical contractor and dealer as limiting their operations to their own legitimate field—I mean private and municipal electric distributing systems. The central stations are in a particularly favorable position to demonstrate the uses of electricity in the home. To begin with they have the energy on their wires going to waste, while you have to buy it. Further than this they stand to gain considerably through the increased use of electrical household appliances by the increase in current consumption. A third reason is that the consumers periodically visit the central station offices and at a time when their minds are naturally turned on electrical matters. It would appear, then, that such continuous demonstrations as are constantly carried out by many of our central station organizations are entirely in the interests of the electrical contractor and dealer in that they are educating the public much more rapidly than could otherwise be accomplished. Whether or not the central station is justified in going beyond this point and becoming a competitor of the contractor and the dealer in the sale of appliances and in undertaking installation work is, of course, outside this discussion. I simply mention it to indicate to you that I appreciate the need of the adjustment of certain of these little matters and a better working understanding between electrical contractors, dealers and the central stations.

The Architect and General Contractor

Your next most powerful ally would seem to be the architect, and in cases where the architect is less in evidence, the general contractor. Now, I know that the mention of the architect in connection with electrical work is certain to provoke a smile, but the reference is rather to what the architect might do than to what he is doing. I have in mind a recent specification for a large department store, stating that the wiring must be done according to the Canadian Electrical Code (whatever that may be) and that the contractor must be willing to move any outlet in the building at the will of the architect, without extra charge, within a radius of eight feet. Imagine figuring, in a job like this, on your cost of material, to say nothing of time and other items. We must remember, however, that the architect and the general contractor have not had our electrical advantages—they are in the position originally occupied by the farmer and his telephone, but they are, for the most part, a fine lot of open-minded men, ready to hear your side of the question, and no doubt willing to co-operate with you. An association such as yours has no more important work before it than the conversion of the architects and the general contractors. In my opinion you should lose no time in appointing a strong committee, if you have not already done so, to meet their societies and endeavor to further your interests by a better mutual understanding. We cannot easily overestimate the good influence these architects and contractors may exert on their clients because, in the majority of cases, they are their advisers throughout the whole work. If, then, the co-operation of these men can be enlisted the task of the electrical contractor, and incidentally of the electrical dealer, the jobber and the central station, will be much easier.

Make it Easy for the Householder

And now for the other important factor—no householder can "do it electrically" if his home is not properly wired and otherwise equipped. Do you imagine the man who lives in a big apartment house could be interested in the purchase of a lawn mower or a snow shovel? Or, do you think the man who hasn't a motor-car cares anything about the price or qualities of gasoline? It is the same with the householder whose home is not properly wired. He cannot use electrical appliances and so, why should he care about them?

The biggest incentive in the world to a man to buy anything is to create the need for it. The man who owns an automobile comes to buy gasoline; he doesn't wait to be solicited. Don't you find it works the same way with the householder and his electric wiring? If he has the facilities for using electrical equipment staring him in the face day after day he will soon come to you for the equipment itself. If he has not these facilities no amount of argument or advertising can be of any value. You electrical contractors, then, in so far as it is in your power to make your installations more complete, more elastic, more of the nature to create a want for electrical appliances to use on the installations you make, hold the key to the situation in your own hands.

Here's a case in point. A few days ago I happened to be looking over a house just completed in a large town (almost a city) north of Toronto. One of the first things the lady of the house called my attention to was the outlet in the upper hall. It was placed in the ceiling but equipped only with a pull chain. She was naturally greatly annoyed because it was not switch controlled and also because she had since heard that there was an arrangement by which both hall lights could have been controlled from switches upstairs and downstairs. Why didn't the contractor tell her, she said. She went on further to complain that she had been down to the company to buy an iron to use in the kitchen but the solicitor who came up to see about it told her she could not use it; this time it was apparently because she had one of those adjustable pendant arrangements in the kitchen with the wire in the flexible not heavy enough to carry the iron. In this same house the meter was installed in the farthest corner of the attic, although there was an ideal place in the basement for it.

Now, I don't attempt to place the blame for these conditions, but on the face of it the electrical contractor was partly at fault; the architect, of course, was at fault, too, and the owner himself—but they did not know. This contractor evidently thought electricity was used exclusively for lighting, that any job was "good enough," and that he himself was a "wireman"—no more, no less. The dignity of his profession, the possibilities of his work, he had plainly never considered. You may say that competition drove him to it. In this case it certainly did not; money was not a strong consideration with the house-owner. I simply mention this case as one that may be considered as fairly typical of much of the "wireman's" work that is being put in from day to day; possibly not in the towns and cities represented here (you are the best judges of that) but at any rate it often represents the attitude of men from whom we have reason to expect something better.

What is an Electrical Contractor?

My own idea of an electrical contractor is that he ought to look upon himself in the light of a distribution engineer for every job he takes in hand. Our electrical engineers, associated with, or called into consultation by our generating companies, always ask such questions as—what load, what kind of load, where is it situated, and especially, what are the prospects of future development? I put it fairly to you if, as electrical contractors, your procedure should not be along the same lines? Consider what your customer is likely to want in the future. Tell him the situation, the possibilities, the probabilities. Urge him to look a little way into the future. You will not win out every time, of course, but you often will.

No doubt your association has its hands full with problems already, but it has often occurred to me that electrical

contractors might replace the present cut-throat competition in prices, with its inevitable results, by a co-operative understanding that the cost of wiring a residence properly ought to be about so much—say 2 per cent. I know that this is higher than much of the work is being done for, but, naturally enough, if the architect says to a customer who is building a $10,000 house, "Oh, don't bother about the wiring, that will only cost you $40 or so," it is very hard to get that customer to consent to pay $200—about what he would have to pay to get a fairly complete job. This is merely offered as a suggestion. If you, as an association, could adopt the principle and could get the architects and general contractors to act with you, of giving a man a rough off-hand estimate of 2 per cent. on the cost of his house, you would have made a step in the right direction.

And here I should like to digress just one moment while I have you all together and listening—What do you electrical contractors gain by your price-cutting competitions on house wiring? Do you create any new wiring business worth speaking of? Is it in the interests of your customer that you cut out a switch here, an outlet there, give him inferior material, and so on? Are you helping to elevate the status of the electrical contracting business? Are you not, both directly and indirectly, making it more difficult for the dealer to sell appliances? Are you not, finally, reducing your own profits to the vanishing point?

On the contrary, as I see it, yours is a business where an understanding among yourselves is absolutely essential to serving the best interests of your customers. It is not a question of getting more money for the same work; it is getting more money for more work—it is giving better service—the aim I am sure of every electrical man who is in this hall to-night.

Instances like the poorly wired house mentioned above, could, of course, be multiplied. Another case came to my notice in a smaller Ontario town during the past month. A customer of the lighting company built a big new verandah—nicely boarded ceiling, tile roof, everything closed up tight. The attention of the manager of the local lighting company was drawn to the fact that this extension was not being wired and that the owner would assuredly want some light. "It's up to him," was the casual reply. As a matter of fact the request for light came in within the week. Against such an attitude on the part of electrical men what chance has "do it electrically" to succeed.

One more example—the manager of an out-of-town electric plant recently visited a friend in this city and going over his house noticed a number of baseboard receptacles placed at different points. The manager admired everything and said so, but finally asked—"Now, just tell me what are those brass plates stuck on the baseboards?" I cite these cases merely to emphasize the point that the blame for not doing more things electrically does not always rest with the consumer. A few days ago an acquaintance of mine was telling me how well he was getting on with his new home. Naturally I warned him to be careful about having his wiring work well done and complete. "Oh, yes, I made sure of that," he said. "There were three tenders submitted, one for $86, one for $98 and one for $105. I picked the highest because I wanted it done right." To be sure, one doesn't often meet such childlike faith as this, but here is one case at least where a good house, nine or ten thousand, might, just as easily as not, have been well equipped electrically. Whose fault is it that it will only be half done?

I know that you can, and will, raise objections to certain things I have been saying, but kindly remember, too, that there is also much more that might have been said on this side. The field before us is as wide as the world. The possibilities of "doing it electrically" are as yet scarcely guessed at. It is decidedly in our favor that we have something that appeals to the public on account of its mysteriousness, its cleanliness, its safety, its efficiency, its general application and—it's coming fast—its cheapness. There is no doubt that we, as electricity distributors, are not yet taking the fullest advantage of our opportunities. We are not yet making it easy enough for the public to do what we want them to do. Only will the proper electrical development come when the central station, the dealer, the contractor, the jobber and the manufacturer work together to remove every argument that any consumer can offer against the use of more—always more—electricity. Don't under-estimate the part you, as contractors, must play. Make it your aim to finish every job as near to what it ought to be as you can possibly strain it. The more electricity you cause to be used in the home the more you are assisting in the general uplift of the nation.

I do not believe there is any other line of business of which it can be so truly said that in serving your own ends you serve others—the dealer, the central station, the manufacturer and last and most of all, the consumer.

Licensing Electrical Contractors in Stratford

By F. C. Whatmough*

I have been asked to contribute a few remarks on the subject "Licensing of Electrical Contractors" as we have it in the city of Stratford, also the benefits derived from such a license. At the outset it might be well to state that we have in Stratford at present six licensed electrical contractors. Our population is between 15,000 and 16,000.

The first question suggested was, "What steps were taken to secure the license?" As far as the electrical trade is concerned we had nothing at all to do with it—it was purely a matter with the city council.

The second question was, "What influence had to be brought to bear to ensure its passing?" No influence at all as far as the electrical trade was concerned. The Hydro-electric Commission were at this time asking for the appointment of an electrical inspector in Stratford as well as in other municipalities.

The third question was, "What influence the electrical trade exerted in framing the by-law." In asking the chairman of the committee of the city council (who framed these by-laws), he told me that the electrical trade were not interviewed at all, that is collectively, and as far as I can learn none were approached individually. This, I think, was an error on the part of the council, because with a question of this nature before them it would have been more to their credit and would have created a better feeling had the electrical trade been taken into their confidence on such an important question.

Fourth question, "How is it being enforced?" As to this I would say that it is being rigidly enforced, with the result that since its coming into force we have had only two outside contractors attempt to do business in Stratford and these two contractors were awarded their contracts from outside architects, one in Toronto and the other in London.

Fifth question, "What benefits have accrued since its passing? Has it improved business conditions and eliminated unfair competition?" Yes, it has improved business con-

*Read before Convention of Ontario Electrical Contractors.

ditions and eliminated unfair competition in this way. Before the passing of the by-law there were at least a dozen persons not regularly contractors in the city doing electric wiring. Some were doing it at night (as overtime) others were doing it in the daytime. Some of these persons were employed in the electrical department of the Grand Trunk Railway shops, others were machinists, two were electric linemen in the employ of the local electric light and heat commission, and last of all, one was a saw and axe carpenter. To make matters worse the light and heat commission made no objection to this, but connected the service. The result was that the electrical contractors could not do business with competition of this class, which from our standpoint was the very worst kind of competition. This was about the time that the Hydro-electric Commission were asking for the appointment of an inspector in Stratford as in other places. The council evidently saw the necessity of some form of by-law governing the erection of buildings and the inspection of electric wiring, with the result that in February, 1914, a by-law was passed and we were officially notified that to continue business in Stratford it would be necessary for us to procure a license. If the members will kindly bear with me for a few moments I will read a copy of the by-law in question, which only amounts to eight short sentences.

By-law No. 2016. City of Stratford. To regulate the erection and provide for the safety and sanitary conditions of buildings, including electric wiring.

Clause 1. All electric wiring hereafter installed shall conform with the rules and regulations as laid down by the Ontario Government from time to time, and it shall be at the option of the inspector to order any wires that are at present in use to be removed and replaced in accordance with the above mentioned rules, or the use of the same discontinued forthwith.

Clause 2. No electric wiring shall be installed without first having obtained the necessary permit from the inspector.

Clause 3. No electric wiring shall be executed within the walls of any building in the city of Stratford save and except by a regularly licensed electrician, or a trained and practical electrician in the employ of such licensed electrician, who shall be responsible for all work done by any one in his employ.

Clause 4. Any person or firm wishing to enter into the business of wiring houses, factories, etc., or anything pertaining thereto shall make application to the city treasurer, accompanied with a fee of $50, when if he or they satisfy the inspector as to qualifications and character a license shall be granted for the current year or portion thereof.

Clause 5. All licenses shall expire on the 31st day of December of each and every year and shall be renewable on the payment of $25.

Clause 6. It shall be construed to mean that where the person does not remain in business continuously the fee shall be as laid down in in section four and in no case will it be considered as a renewal.

Clause 7. Should the inspector deem fit he may cancel any license at any time that the foregoing sections are not complied with, and it shall not be renewable except by the consent of the council, and in any case where a license is cancelled the money paid shall remain with the treasurer of the city.

Clause 8. No contract shall be considered complete until inspected, when if found in accordance with the above rules the inspector will furnish the contractor and owner with a certificate which must be presented when making application for current.

The sixth question asked me was, "Is it working satisfactorily, or are there some points open to criticism?" It is working fairly satisfactory as far as the contractors are concerned, except that if one of our employees wishes to wire his own house he can buy the material from any one of the contractors, install it himself, and if installed according to rules, is passed by the inspector and the service connected. This is a point which I think is open to criticism and should be discussed by this convention.

Seventh question, "Do you feel the need of a provincial license as compared with a municipal, or assuming that surrounding municipalities had similar local license laws, would you not require a provincial license?" Yes, I think that we should have a provincial license, but whether or not it would be wise to have both municipal and provincial licenses I hardly care to even venture a suggestion, in fact this question to my mind will require some careful thought and study.

Department Store Competition

By W. R. Herstein*

A leading electrical journal recently took occasion to call attention, editorially, to the fact that the merchandising of electrical household goods is rapidly passing into the hands of the hardware, drug and department store. The reason for this is not, as might seem at first thought, a matter of price, but because the electrical retailer, whose chief business is contracting, does not keep abreast of the times in the mercantile end of his business, looking at it as a side line. It is pointed out that the merchandising of household devices is well worthy of serious thought. It possesses far less hazard than the contracting business itself, is continuous and cumulous, and yields a steady, generous profit.

"The mere possession of a store and someone to attend to customers," recites the article, "is far from being all that the public desires and the opportunity demands. Trade automatically flows to the attractive, well arranged and well lighted stores, where good service is a conspicuous and pleasing feature. Many electrical stores to-day can hardly be called inviting. The service is poor. The display of goods is far below the standard the public is accustomed to. A workman with dirty hands comes out from the shop to wait on customers, or the everbusy contractor himself attempts to drop his other and more pressing interests and be the salesman in emergencies. The atmosphere of the store is wrong."

An attempt to argue the self-evident truths contained in the editorial referred to would be a waste of time. A decidedly more profitable action would be to discuss and decide upon means to cope with the situation presented by the department store and similar competition. It should be remembered, first of all, that though the department store has invaded the retail electrical field, it does not necessarily follow that the retail electrical store must disappear, or that it cannot continue to operate successfully and profitably. The department store has invaded practically every other field, and yet the number of millinery shops, men's furnishings establishments, shoe stores, restaurants, soda fountains, etc., has not perceptibly diminished. These smaller merchants have solved the problem successfully, and it behoves the electrical retailer to profit by their example. Indeed, the electrician's task is far simpler than the difficulties besetting

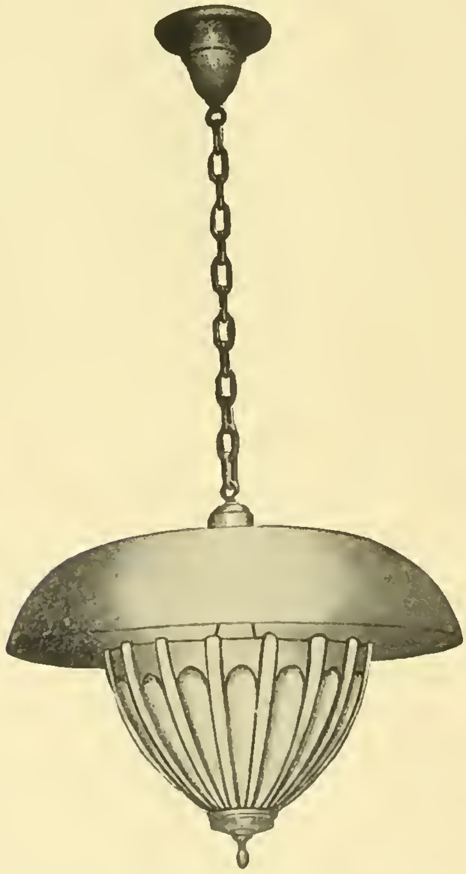
*In National Electrical Contractor.

other lines of trade, when it is recalled that he represents a highly technical business and one which the hardware, drug or department stores are not really equipped to handle, with the cheap and inexpert salesmen they usually employ.

If I were an electrical retailer, I would use this fact as the foundation of all my advertising. I would feature the hazard of purchasing delicate and intricate apparatus from a merchant who did not understand the first principles of its theory and manufacture. I would dwell upon the advantage of having back of the device, a local, responsible and capable dealer, and not merely the guarantee of a manufacturer possibly a thousand miles away. If I had retail electrical competitors in my town, I would avail myself of that spirit of co-operation fostered by the National Electrical Contractors' Association, and arrange with these competitors for a united local advertising campaign, tending to lead electrical buyers into electrical stores.

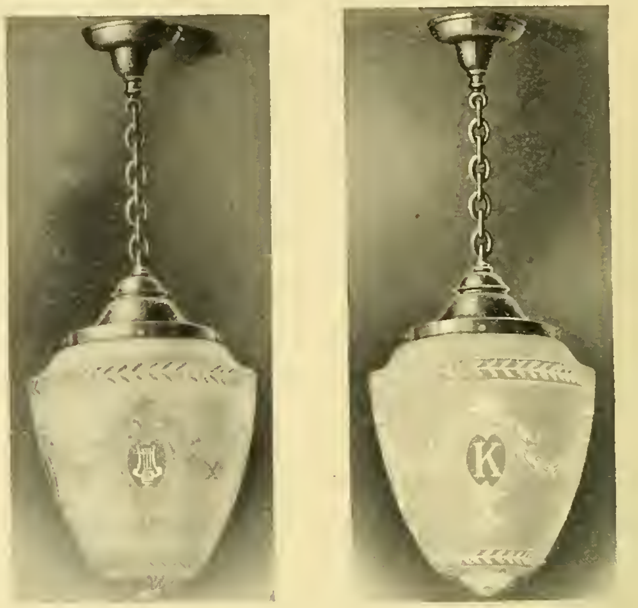
Having gotten them into my store, I would see to it that they received the impression of a neat, well ordered establishment, removed from every suggestion of a workshop, and that the demeanor of myself and my clerks toward the customer would be as similar as possible to that which I have observed when I, myself, have been a customer in a high class retail store.

I would consider carefully the arrangement of my window, shelf and show case display, specializing at the proper times on seasonable goods. I would remember that the display of fifty different articles in one window presents only a confused jumble, and instead, I would fill my window, for instance, with fans alone at the outset of summer, and with incandescent lamps alone when the first cool spell in autumn drives the people indoors at night. At other periods I would display flatirons only, percolators only, dry batteries, portables, and so on throughout the list, feeling that gradually an impression of each item of my entire stock would be fixed on the public mind.



Phenixlite—an efficient unit shown by McDonald and Willson, Ltd., Toronto.

Uncle Remus' story of the rabbit that climbed a tree to escape the pursuing dog is a case in point. When the Little Boy made the objection that rabbits could not climb trees, Uncle Remus replied that this rabbit simply had to climb a tree. So it is with many electrical retailers, who of the business that to withdraw and retire to contracting are already so heavily involved in the merchandising phase exclusively cannot be done without serious and perhaps fatal loss of capital. By such dealers, the issue presented by non-electrical competition must be faced. That the problem is not hopeless is shown by parallel experience in other lines. That the situation has been studied and successfully met by many contractors is evident to anyone who has visited the trade and seen the many electrical retail stores now established, which might serve as models for much more pretentious businesses.



Special designs of beautiful glassware—Macbeth, Evans Glass Co.

Remember that you are in business for keeps. Study the methods of your competitors and neighbors. Take a trip to some town where the contractors have already seen the light. Then go back to your own place of business, put your house in order, and say to yourself every day, and many times every day: "This community must recognize that the electrical store is the place to buy electrical goods."

New Books

Manual of Car Lighting—by Edward Wray; Wray Publishing Company, Chicago. This book has been compiled entirely from a series of lessons published in the Railway Electrical Engineer, beginning with February 1912 and continuing at certain intervals through forty-two issues. The book also includes all the lessons of the Pennsylvania Railway School of Electricity so far published by that railway. There is also included the department known as the "Railroad Electricians' Club" published in the Railway Electrical Engineer and the department of "Practical Stunts" and the "Question Box" also published in this magazine. Railway men and electricians having to do with the construction, installation or care of any form of electrical railway equipment will find this book of very great service. It contains 340 pages, well illustrated. The size of the page has been kept the same as in the original issues of the Railway Electrical Engineer and in bound form measures approximately 9 inches by 12 inches.

Canadian Hart Accumulator Company

The Canadian Hart Accumulator Co., Ltd., have recently built a new factory at St. Johns, P. Q., for the manufacture of electric storage batteries, and installed the equipment during the summer months. The works are situated on the outskirts of the town adjacent to the G. T. R. tracks, from which railway a spur will be taken into the factory.

This company is a branch of the well-known English company, the Hart Accumulator Co., Limited, of London, whose manufactures are distributed the whole world over. The Canadian company manufacture at St. Johns, Que., the same type of cells as those of the English company, by the same processes and under the same close supervision, which has resulted in the high reputation they bear to-day. The cells are of the lead-sulphuric acid type, and while not making any radical departures from general principles, several improvements have been made. The types of plates built are the Plante, the well-known Hart Demi-Plante, and the various pasted plates for traction work.

Among the stationary type of cells manufactured are those used for central station lighting and power, street

Mr. C. W. Knighton.

railway operation, farm and other isolated lighting plants, fire and police alarm circuits, and telephone and telegraph companies. Many portable types are built and are suitable for automobile lighting and starting, yacht lighting, electric motor boats and electric trucks. The company are building, in addition to their English standards, new types for automobile lighting and starting and for electric trucks which perhaps are more suited to Canadian conditions. The company have recently obtained orders from: The Cedars Rapids Mfg. & Power Co., Cedars, Que., for a battery of 122 cells, 600 ampere-hour capacity for main oil switch operation and stand-by lighting; the C. P. R. Co., 1 battery of 114 cells of 680 ampere-hour capacity, 3-wire reversible booster and switchboard for their Algonquin Hotel, St. Andrews, N. B.; Electrical Standards Laboratory, Department of Inland Revenue, Ottawa, 1 battery of 56 cells 220 ampere-hour capacity; General Railway Signal Co. of Canada, Ltd., Montreal, 2 batteries each 55 cells, 90-ampere-hour capacity, for electric signalling; Department of the Naval Service, Ottawa, 1 battery 52 cells, 90 ampere-hour capacity; Town of Shoal Lake, Manitoba, 1 battery of 120 cells, 520 ampere-hour capacity to operate in connection with town lighting plant; the order for this latter battery was secured by the company's agents, The Accumulator Lighting Company, Ltd., of Winnipeg, and erected by them.

Mr. C. W. Knighton is the engineer and general manager of the company, and has his office at 301 Guarantee Building, Beaver Hall Hill, Montreal. Mr. Knighton has made a preliminary trip through the country from coast to coast. We understand this is the only storage battery company manufacturing on a large scale in Canada, thus affording Canadians an opportunity of securing Made in Canada goods when they are in the market for storage batteries.

The company are represented in the West by: The General Supplies Limited, 122 Eleventh Ave. West, Calgary, Alta., and the Accumulator Lighting Co., Isabel Street, Winnipeg, Man.

Made-in-Canada-Sold-Everywhere-Goods

The stoppage in supplies of electrical accessories from Germany and Austria as the result of the war is the opportunity of the Canadian manufacturer to secure a stronger hold on the home market. The German in particular is a great copyist, and succeeded by this means and also by cutting prices in securing a large volume of business in electrical accessories; some of the goods it may be admitted were of very poor quality, but they were cheap, and no doubt appealed to a section of the consumers, who valued price more than quality. This view was emphasized by Mr. Charles Duncan, of the Duncan Electrical Company, Limited, Montreal, in an interview with a representative of the Electrical News. He pointed out that with these foreign goods out of the market, buyers are bound to look to other sources for supplies. Will Canadians allow outside manufacturers to step in, or will they grasp the chance that is within their reach?

It is a difficult matter in normal times to divert the course of trade, particularly when commodities are placed on the market at low figures, but now is the time for our manufacturers to take advantage of the unusual conditions, and also to prepare for the increased business which will follow the close of hostilities. It is obvious that in these days of restricted dealings our manufacturers have more time to lay their plans for an aggressive campaign in the future; it is not good policy to wait until peace is declared; now is the moment. Already some electrical firms have captured a share of the trade which formerly went to Germany and Austria; they are supplying the needs of the public, and profiting by experience, are putting out articles of greater merit at, in some instances, the same price, and in others at slightly higher rates. They are translating the Made-in-Canada slogan into practical business. It is useless to ask people to buy domestic goods unless our manufacturers can produce goods which are at least equal in quality to those they seek to permanently displace.

Mr. Duncan stated that his firm was among those who were aiming at securing orders which formerly went to our enemies. The firm had spent considerable sums in improving many of the accessories which used to come from abroad; they had been successful in several directions, and with the return of peace looked for a decided quickening of trade, with, naturally, benefit from their efforts to keep the business in Canada. The Germans should not have a look-in in many lines where it has been proved that we can give a better article at the same price. It is folly, however, to sit still and argue that German and Austrian goods will not be bought in the future owing to the intense feeling of disgust engendered by the war; what Canadians have to do is to get busy and show the buyers that we can produce articles which are of better quality than those which came from Europe. Let us get after the business—not rely on an estranged public opinion.

What is New in Electrical Equipment

Water-tight Floor Box

The cut herewith illustrates the Acme patented floor outlet box of the Canadian Krantz Manufacturing Company, Toronto. This outlet box is universally adjustable and watertight. The cover can be tilted half an inch in either direction and raised or lowered half an inch or more. The adjustments are made on the inside of the box. Electrical connections can be made without breaking joints at the floor flange. The maximum height of the box is 4⅞ in.; depth of cover flange 4¾ in. This floor box and other types of floor boxes and receptacles are described in bulletins Nos. 42-43-44 and 45 just published by this company.

Acme Outlet Box.

New Bell Ringing Transformer

The Junior bell ringer is designed for all classes of light signal work such as may be found in the ordinary residence or flat building, and will also operate all standard types of door openers. Jefferson bell ringing transformers are claimed to be superior to anything else on the market because they will handle a greater and wider range of signal work and have a larger capacity. They embody all the essentials of a perfect design, electrical, magnetic and mechanical. These transformers are designed to be connected to the ordinary alternating current lighting circuit and will step down the voltage to operate all classes of bells, buzzers, door openers, annunciators and other signal work such as may be found in residences, offices, factories, mines, schools, etc.

The Jefferson Junior.

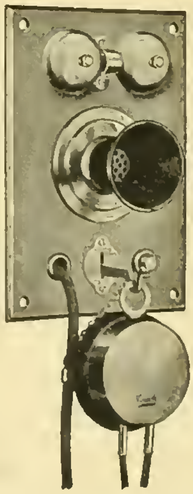
The type "B" bell ringer, 25 watts, is designed for heavier signal work and installations that require more power than is generated by the Junior. Generates three secondary voltages, 6, 14 and 20. The Heavy Duty "B" has an output of 75 watts, generates three secondary voltages, 6, 14 and 20, and is designed particularly to take care of large installations and operate a greater number of bells and other signal devices than the standard Type "B." Type "C" has an output of 125 watts and generates four secondary voltages; namely, 6, 12, 18 and 24; these transformers are designed to take care of extra large bells and other signal work, such as is found in schools, factories, mines, etc.; particularly suitable for large alternating current type bells. These transformers eliminate the use of all types of batteries and once installed will last a life time. The agency for the "Jefferson" lines is in the hands of the Premier Electric Company, Limited, 74 Victoria Square, Montreal.

Color Lamps with Shaydolite

Shaydolite is a clear, exceedingly transparent coloring for lamps, giving the effect of glass colored in manufacture, rather than that of a color subsequently applied. It is made in a variety of beautiful shades, and is also supplied in white frosting. It is weather-proof, and is used by the British and Japanese Navies for their decorations at reviews, etc. The leading London theatres, exhibitions and places of amusement, as well as railway and steamship companies all over the globe, use Shaydolite, not only on account of its beauty, but also because of its reliability and uniformity. It is very easily applied, and dries in a few minutes. Canadian agents, Spielmann Agencies, Montreal.

Flush Telephones

The Norton Telephone Company are showing some new types of flush telephones for apartment houses and residences. These types can be finished to match the woodwork or wall finish. Among the systems sold recently the special finishes have included white enamel, mahogany, brush brass and dull black. In one instance the telephones of the standard desk type were finished in white enamel.



Norton Flush Telephones for apartment houses, etc.

Boston Brewer Has Electric Sign Truck

Haffenreffer & Company, of Boston, use the five-ton G. V. illustrated below for advertising their stock ale. The truck is nothing but an animated electric sign and has created a great deal of attention not only among Boston merchants but among central station men and the merchants of other cities.

They first bought a five-ton G. V. chassis equipped with Edison A-12 Battery. The cab and body were built in Boston. The total cost of the truck as illustrated was about $6,400. The advertising body can be discarded at any time and the regular brewery truck body substituted.

The frame work of the body is structural iron, the flat work galvanized iron. The signs are removable and the body of each sign is vented to let the water drain. The main body color is a handsome shade of green. The running gear is red and the sign background black. The lettering is in gold-leaf. The front sign (over cab) is glass with red background and gold letters. On each side of the body there are sixty-six 55 volt lamps, the body being 14 ft. 9 in. long. The rear end has twenty 55 volt lamps and the front end six 55 volt lamps.

All lamps have pear-shaped reflectors. All lamps have screen protection, ¼ in. mesh net, except front sign. Lettering sides and rear end of sheet iron, raised. Front sign, covered with glass. Other signs exposed. Back of driver's seat Cutler Hammer resistance 84 volt, 36 ampere. Resistance has knife switch so that illuminated signs may be turned off. Ampere and volt meter on dash.

Electric illuminated trucks for advertising purposes will, in the opinion of many electrical men, soon come into general

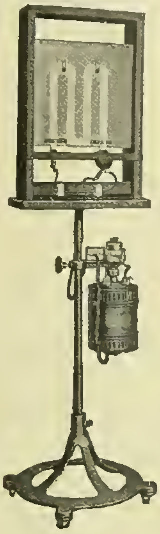
Truck with electric sign body.

use. The Haffenreffer truck is very unique, however, in that the advertising body is practically interchangeable with the working body of the truck.

Photographic Enlarging Outfit

Photography, like every other industry or trade, has made tremendous advances in recent years, due to the demand for high grade work. Especially has this been the case with enlargements of photographic negatives which require special lighting facilities for producing the best results. What is required is a steady light without flicker or variation and one that could be used without condensing lenses or other diffusing media. An illuminant was also required that had a long life and did not require constant care and attention. For enlarging purposes the illuminant must bring out the roundness and the atmosphere of the negative without accentuating any of the retouching or coarseness that would detract from the finished picture.

This ideal has been practically realized for some time past with the use of one or more Cooper-Hewitt twenty-inch tubes which gave the desired quality and quantity of light. It was found, however, that the efficiency would be very materially increased if it could be arranged to concentrate the maximum amount of light directly behind the negative. Realizing this fact the Cooper-Hewitt Electric Company has brought out an M-shaped outfit which accomplishes the desired object in a very simple manner. So-called from its



M-shaped enlarging outfit of Westinghouse Company.

similarity in shape to the letter M, this outfit consists of a 50-inch tube bent at six points. The tube in this shape gives a strong even field with two sheets of ground glass which can be placed within 3½ inches of the tube and within one-half inch of the negative. The outfit can be furnished for either direct or alternating current circuits, and may be mounted on a stand. A number of these devices are in use by photographers who claim that they are able to obtain excellent enlargements in considerably less time than with other light sources. Among the particular advantages obtained by those using this outfit are that it affords an even distribution and a steady glow of purple rays, whereas the arc lamp has to be adjusted at frequent intervals, and that there is an absence of glare often observed from an incandescent source.

Illumination of Building Exteriors

An interesting out-of-door illuminating scheme has recently been installed at the new plant of the Eli Lilly Company in Indiana. The two main buildings of this company are connected by a long pergola with an impressive tower in the centre. Numerous attempts were made to illuminate this in a manner which would provide a soft general lighting effect. Arc lights, flares, roundhouse lamps, and chains of incandescent lamps with small reflectors were tried, but were not found effective. Then it was suggested to try "Golden Glow" harbor range lights, manufactured by the Esterline Company, Indianapolis. A trial installation of ten lamps was made, burning five in series on the 600-watt interurban circuit, and the result was so satisfactory that the entire equipment was purchased and permanently installed.

The accompanying photograph of the illumination was made in a forty minutes exposure, and neither the photograph nor the negative are at all retouched. It is interesting to note that the fields in front of the buildings are planted with belladonna, never raised in this country so extensively before the war. The small illustration is of the type of lamp used, a standard "Golden Glow" headlight which

Flood lighting of building exterior with Golden Glow units.

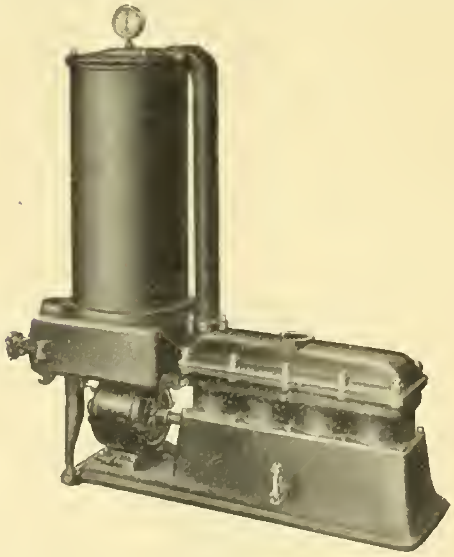
was originally designed for government harbor range lights, in which service they are extensively employed.

These lamps are mounted on concrete bases and are so close to the ground as to be unnoticeable in day time, and at night it is hardly possible, from the road, to tell where the sources of light are. The lamps are all equipped with 120 volt, 250 watt, G-30, concentrated filament, gas filled, mazda bulbs. The fact that no maintenance is necessary with the mirrored reflectors in the "Golden Glow" lamps, and the long life of the bulbs makes the installation an ideal one. The wires are all laid in conduits.

Similar installations with "Golden Glow" range lights and searchlights have been made elsewhere to illuminate buildings, signs, water towers, and construction work. The quality as well as the quantity of the light has proven an interesting factor, because it is non-dazzling, fog and rain penetrating, and does not blind those working in its light.

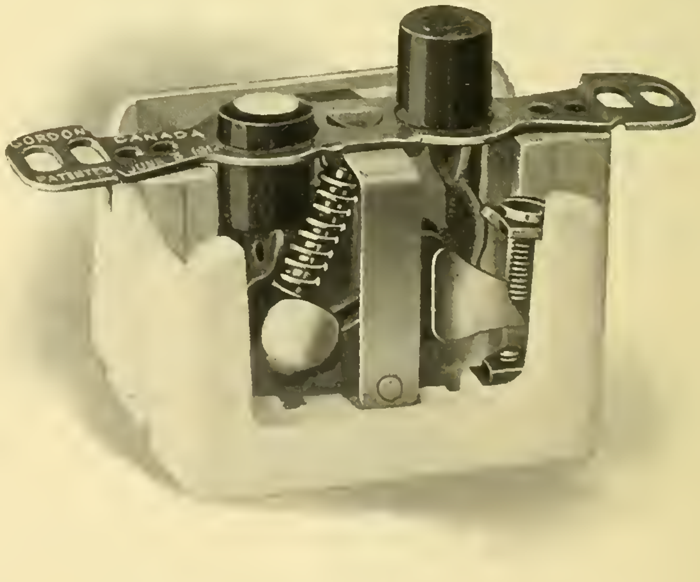
New Stationary Vacuum Cleaner

The new vacuum cleaner illustrated is made exclusively for residence service by The Palm Vacuum Cleaner Company, Detroit. Instead of the rotating fan commonly used to provide the vacuum, this outfit is equipped with a four cylinder vertical plunger vacuum pump which is direct connected to the motor. On a closed system the pump will show a vacuum of 7 inches of mercury, and the air displacement at the end of the hose is 50 cu. ft. per minute. The outfit is equipped with an automatic lubricating system and needs attention but once or twice yearly. It has a collapsible self-cleaning bag and removable dust pan. The equipment is very compact and all moving parts are enclosed. One pipe connection only is required, and it is not necessary to bolt the machine to the floor. This cleaner is equipped with a ½ horsepower direct or alternating current motor, made by The Robbins & Meyers Company, Springfield, Ohio.



Sherbrooke Railway & Power Annual

A small increase in the net revenue is shown by the annual report of the Sherbrooke Railway and Power Company for the year ended June 30. The gross revenue was $146,769, against $141,990, but against this working expenses increased from $87,969 to $90,848, leaving a net revenue of $55,920, a gain of $1,900. Mr. Clarence J. McCuaig, the president, states that as a result of the war many manufacturers curtailed their operations, thus reducing the demand for power, and this naturally affected the revenue from electric light and street railway departments. To make up for this reduction in the revenue the directors decided to purchase the lighting and power business of Waterville and Compton, together with certain rights in the Coaticook River Power Company, and an undeveloped water power, and were also obliged to extend several lines to secure other contracts. As a result practically the whole of the power from the present development has been sold and will substantially increase the revenue when in operation. To cover the financial requirements, $100,000 of 7 per cent. short term notes will be issued. Reference is made to the services at the front of Major D. R. McCuaig, D.S.O., one of the directors, who was seriously wounded in the battle of Langemarck and is now a prisoner in Germany, and who has almost recovered from his wounds. Major N. C. Pilcher, the general manager, is also abroad, having accepted an appointment with the 5th Royal Mounted Rifles; during his absence, Mr. J. H. Trimingham, general superintendent, is administering the affairs of the company.



"King" Flush Switch Manufactured by Electric Specialty & Supply Company, Toronto.

"Good Lighting" in factories prevents accidents and increases both the quality and quantity of the product.

Clocks in Synchronism

The advantages when all clock dials throughout a building or over a certain area register exactly the same time are often too considerable to be estimated. A system which is being used largely in England her colonies as well as in several foreign countries and known as the "Synchronome,"

Combined clock and standard in St. John, N.B.

is claimed to be giving a very high degree of satisfaction. One of these installations was made not long ago in the city of St. John, N.B., one of the units of which is represented herewith. The advantages claimed for this system are: Its complete automatic action, as not even the master clock requires to be wound up. Absolute synchronism of any number of dials. Small consumption of current, which may be taken from any source desired. Impossibility of stopping in closed contact. Great accuracy of time keeping, which is unaffected by variation of battery. Facility for automatic synchronization by official time signals. This equipment is manufactured by the Synchronome Company, Limited, 32 and 34 Clerkenwell Road, London, E.C., who are now on the lookout for a Canadian sales agent.

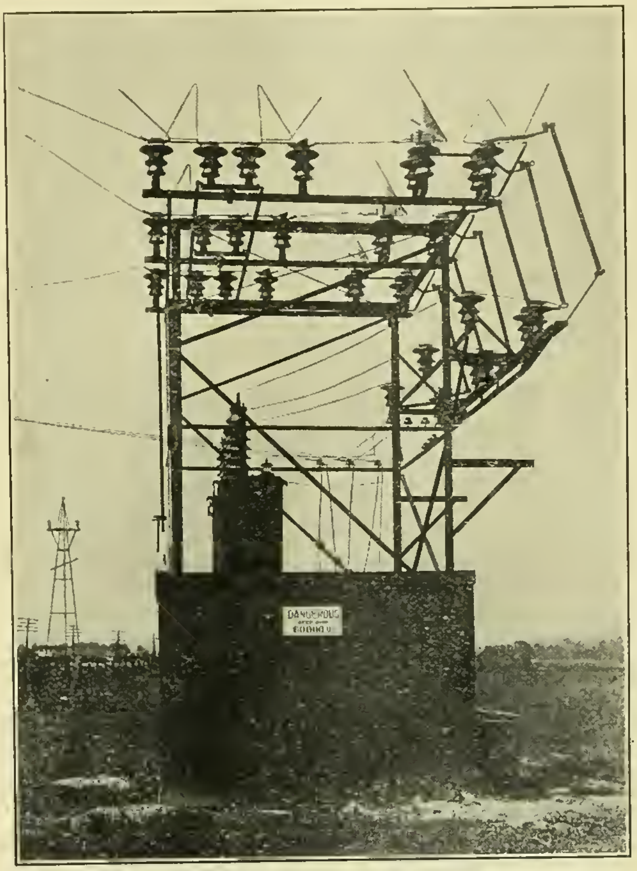
Triangle Strain Insulator

The insulator shown herewith is known as the Triangle Porcelain Strain Insulator and is manufactured by the Illinois Electric Porcelain Company, Macomb, Ill. The claims made for this insulator are that it has 50 per cent. greater leakage

distance than any other porcelain strain insulator, that it is 30 per cent. lighter in weight and that the material is distributed in such a way that the body is nearly the same thickness throughout. In addition, the shape of the insulator permits of its being made up so that the porcelain is much more dense than in the ordinary form.

Low Capacity 66,000 Volt Sub-Station

The accompanying cut pictures a low capacity 66,000 volt sub-station developed and built by the Railway and Industrial Engineering Company, Pittsburgh, Pa. The station shown is at Bergen, N. Y., and is one of several on the lines of the Niagara, Lockport and Ontario Power Company used to serve power to various towns. At the Bergen station there are at present installed two 25 kw. 66,000 volt Westinghouse transformers, but the platform on the steel structure is arranged so that a third transformer can be installed later when the load is increased. The switching and protective apparatus consists of a standard 70,000 volt Burke horn gap switch and Burke horn gap lightning arrester, choke coil and fuse. The station is complete in every respect but very



simple and compact, all of which is necessary for a station of this low capacity where the initial investment must be kept at a minimum in order to return a proper income.

A manufacturer, interested in meeting the requirements of the National Code, asks us to publish the following question in the hope that it may elicit a solution from engineers or others interested in safe switches:—

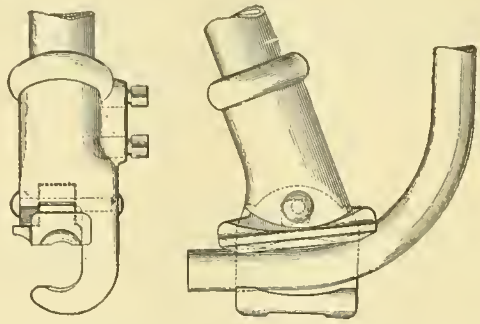
Question: How should a combination switch and cutout be arranged or designed so that no live parts can be touched by persons re-fusing the cutout until the latter has been disconnected from all sources of electrical energy?

This question is based on the proposed recommendation No. 324-A of the circular of the Bureau of Standards, U.S.A., No. 54, on the Proposed National Electrical Safety Code.

The Robbins & Myers Company, manufacturers of electric motors and generators, Springfield, Ohio, were awarded the grand prize for the best exhibit at the Panama-California Exposition at San Diego. The same company was also awarded a gold medal for their electric fans and motors at the Panama-Pacific Exposition at San Francisco.

The Fey Hickey

The Fey Specialty Company, Detroit, Mich., have just brought out a new tool known as the Fey Hickey, specially designed for bending conduit. It is provided with one solid and one movable jaw, the latter of which, operating by the pressure required to bend the conduit, automatically clamps



it while the bend is made. This makes slipping impossible and roughening the jaws of the hickey is unnecessary. The jaws are made alike at each end so that bends may be made by moving the handle in either direction. The device is illustrated herewith.

High Capacity Steel Tower Out-Door Sub-Station

The Moloney Electric Company of Canada, Limited, have announced a new form of steel tower, high tension, out-door sub-station, as shown herewith, Fig. 1. This station is

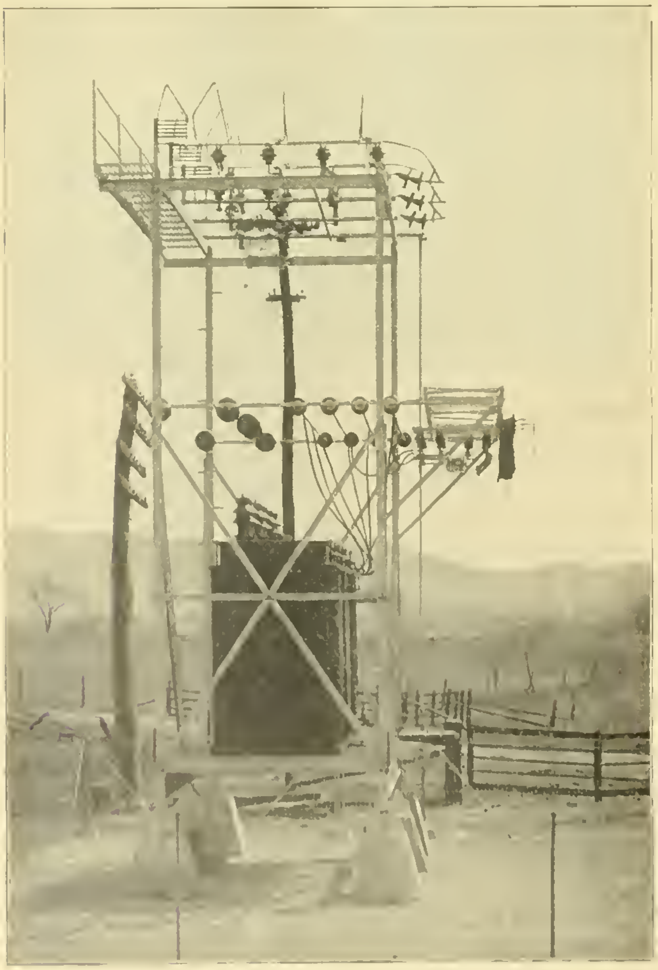


Fig. 1.—900 Kv.a 22000/4000/2300 volt station.

manufactured by the Delta-Star Electric Company, Chicago, is known as the type "CAG," and can be used for very heavy capacity installations. The switching, fusing and lightning arrester equipment is of the standard "SRE" form, and can be adapted for various kilowatt loads by simply changing fuses. Among the advantages of this form of station is that it is self contained, increase in capacity can readily be taken care of, and provision is made for easily handling the heavy transformers. A unique feature of this design is that by means of suitable steps and top platform rack a lineman can easily, safely and quickly inspect the equipment, make adjustments, etc.

Fig. 2 shows an installation of 66000-volt 3-phase air

Fig. 2.

break switches used for sectionalizing the main line, the switch being operated from a platform. With this arrangement a high factor of safety is secured, as the locking type operating handle is permanently grounded, the operator being at a safe distance from the high voltage lines. All line strains are taken up by the dead end insulators attached to steel channel cross arms—which in turn support the switch units. The switch is of the standard type "PM" form.

New Hubbell Devices

The increasing use of armored cable has created a demand for a plug cap which can be rigidly attached to the

Fig. 1.

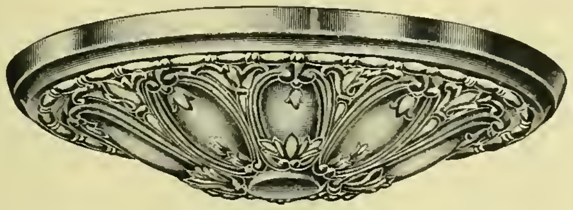
Fig. 2.

metal casing of the cord. To meet this demand Harvey Hubbell, Inc., have placed on the market two new caps. A brass ring swivels round a specially formed composition

bushing, securely gripping the metal covering, thus making the knotting of wires unnecessary, there being absolutely no strain on the wire itself. The cap illustrated in Fig. 1 is equipped with standard contacts. Another cap is fitted with the small type. Both are interchangeable with the entire line of Hubbell "T" slot wall and flush receptacles.

Fig. 2 shows one of the two new 6 in. bowl type diffusive reflectors just placed on the market by this company. These shades were primarily designed to meet the requirements of the Industrial Trade, being particularly adapted for bench work. The maximum efficiency is obtained when used in connection with 25 and 40 watt lamps, the neck being so arranged that when the lamp is inserted a considerable radius is illuminated and at the same time the strongest light is concentrated directly beneath the unit.

The Halifax Tramway Company are having built six cars which are expected to be completed and in service by October 1st. G. E. motors of the interpole type are being installed in the cars, which are being built at the Nova Scotia Car Works.



Attractive canopy design—Plume & Atwood, Waterbury, Conn.

Trade Publications

Fuses—The D. & W Fuse Company of Providence, R. I., are distributing copies of their new fuse book in which some interesting facts are given regarding the design and construction of D & W encloses fuses.

Flextube—folder issued by the National Metal Molding Company, Pittsburgh, Pa., describing their double compound, seamless, interwoven, flexible conduit.

Show Window Reflectors—Booklet issued by the National X-Ray Reflector Company, Chicago, describing and illustrating standard show window reflectors for store and showcase lighting. The booklet also contains a quantity of valuable information regarding the proper type of reflector to use in each case and the method of installation.

Condulets—Catalog No. 1000-C, distributed by the Crouse-Hinds Company, Toronto, Canada. This is a supplement to catalog No. 1000 and includes bulletins No. 1000-A and No. 1000-B. It describes condulets for every purpose; thoroughly illustrated.

Westinghouse Publications—Folder No. 4197-H of household helps; leaflet No. 3760, describing types EC and EH switchboard; leaflets 3789 and 3790 on semi-magnet and full-magnet elevator control; leaflet No. 2322-C, covering type AR single phase motors; leaflet 2362-C on type CA single phase small motors; catalogue section DS-930, describing electrostatic ground detectors and voltmeters; folder 4202-A, describing telephone battery charging with mercury rectifier.

Trade Inquiries

999. **Telegraph poles.**—An Edinburgh firm who do a large business in telegraph poles both for Government purposes and also small poles for mining districts, would be glad to be placed in communication with Canadian manufacturers and shippers in a position to do export trade.

Personal

Mr. W. B. Baptist, manager of the North Shore Power Company, Three Rivers, P. Q., has been appointed captain of the No. 3 Company of the old 86th Battalion, which has been reorganized as an English-speaking instead of French Canadian battalion.

Mr. W. M. Turnley has resigned his position as sales manager of the Northern Electric Company of Montreal to become manager of the Canadian Carbon Company, Limited, Toronto, manufacturers of dry cells, flashlights and other electrical specialties.

Mr. E. J. Clark, managing director of the Canadian Hart Accumulator Company, St. Johns, P. Q., and Montreal, and of the Hart Accumulator Company, Limited, London, Eng., has been on a visit to this country. The visit was for business purposes and for inspecting the Canadian company's factory at St. Johns.

Mr. M. A. Sammett, consulting engineer, Montreal, has been retained by the Martin-Bennett Asbestos Mines Ltd., Thetford Mines, P. Q., in connection with the electrification of their plant. The installation consists of several induction motors, of a total rating of 1,200 h.p., with switchboard and transformers for lighting. The equipment is furnished by the Canadian General Electric Co.

Mr. James J. Campbell, formerly Montreal district manager of the Swedish General Electric Company, who enlisted with the 13th battalion, 5th Royal Highlanders, has been awarded the Cross of St. George, first-class, by the Czar of Russia, for distinguished conduct. At present he is "somewhere in Germany." Mr. Campbell was also connected with the Canadian Westinghouse Company in Montreal.

Mr. Walter F. Wright has been appointed Ontario Manager of the Eugene F. Phillips Electrical Works, with offices in the Traders Bank Building, Toronto. He will assume his new duties October 1. Mr. Wright is a son of Mr. J. J.

Mr. Walter F. Wright

Wright, founder and former general manager of the Toronto Electric Light Company. After graduating in Applied Science at the University of Toronto he spent several years with the General Electric Company at Schenectady, N. Y., and Denver, Col., returning to Toronto to join the staff of the Canadian General Electric Company. For the past three years he has been Manager of Motor Sales for that company.

Current News and Notes

Bathurst, N.B.

The new electrical installation of the Bathurst Lumber Company was recently put in operation. Power is generated by two 1200 kw. steam turbo sets—the current supplied being 3 phase, 60 cycle, 2200 volt. This is stepped down to 220 volts for motors and 110 volts for lighting. It is also stepped up to 10,000 volts and carried six miles up the river, where an electric pumping equipment is installed for supplying water to a pulp mill. The turbo sets were supplied by the Canadian Westinghouse Company; motors by the Canadian General Electric Company. Mr. A. A. Macdiarmid was in charge of the installation.

Brandon, Man.

A special committee was recently appointed to deal with the question of a new contract for power with the Brandon Electric Light Company. This committee has recommended the acceptance of the company's offer of a time contract at 1½c. per kw.h.

Brigden, Ont.

The ratepayers defeated the by-law asking authority to expend $3,500 on electrical equipment.

Calgary, Alta.

Latest reports are to the effect that the Alberta Hydro-electric Power Company have withdrawn their offer to make a contract for supplying power to the city of Calgary. The proposition submitted by the company was hotly opposed by R. B. Bennett, M.P., who spoke in defence of the bondholders of the Calgary Power Company, claiming unfairness if a contract was made with a second company before any development work had been done and without any guarantee that such work would be done.

Chesley, Ont.

A by-law was carried on September 27th authorizing an agreement with the Hydro-electric Power Commission of Ontario for a supply of electric current.

Edmonton, Alta.

By eight votes to one, the city of Edmonton have decided to submit to the ratepayers a by-law authorizing the city to make a contract with G. W. Farrell & Co., Montreal, for the supply of electric power. The proposal is to develop hydro-electric power on the North Saskatchewan River, 60 miles above Edmonton, and to supply the city with power under a sliding scale of rates, a minimum quantity being fixed. Preliminary plans have been drawn up, Mr. R. S. Kelsch, of Montreal, being the consulting engineer. The estimated cost of the project is $6,000,000.

Fort Frances, Ont.

An engineer of the Hydro-electric Power Commission is looking into the question of power supply for Fort Frances, Ont. The citizens are anxious to have Sand Island Falls developed.

Fredericton, N.B.

The Fredericton Gas Company are making extensive additions to their power plant. A 200 kv.a., 20 phase, 2200 volt, 450 r.p.m. generator with direct connected exciter is being installed. This machine will be direct connected to a Belliss & Morcom 2 cylinder vertical engine. Alterations are being made to the company's present switchboard. A new condenser and pumping equipment is also being installed. This company's business has grown rapidly during the past few years.

Gravenhurst, Ont.

The town council have passed a by-law approving a contract with the Hydro-electric Power Commission of Ontario for the sale to the latter of the South Falls power plant. This plant has a present capacity of 500 h.p., which, it is said, can be extended to 1,500 h.p. The matter will be submitted to the Gravenhurst ratepayers on October 2.

Halifax, N.S.

Moirs, Limited, are making extensive additions to their mills at Bedford. The machinery in both chocolate works and shook mills will be electrically driven. The power house equipment will consist of one A.T.B., 150 kv.a., 220 volt belted generator; one 100 kv.a., 220 volt belted generator, and one 35 kv.a., 220 volt belted generator. These machines, together with exciters, will be driven from water wheels. The switchboard will consist of five panels. Some twenty motors, ranging in size from 2 to 30 h.p., are being installed. The plant is being supplied by the Canadian General Electric Company, and is being installed by the firm's own electrical staff

Hamilton, Ont.

The Automatic Telephone Company, Chicago, have submitted an offer to the civic council covering the immediate installation of 5,000 automatically controlled telephones and equipment sufficient for extension to 12,000.

Kensington, P.E.I.

A new company has been formed here for electric lighting of the town. Power is being developed at Mill Valley, three miles from town. A 100 kw., single phase, 2000 volt generator is being installed. It is expected that light will be turned on about October 1st. J. T. Thompson is president of the company. The plant is being installed by R. K. Clements, of Middletown, N.S.

Kentville, N.S.

The Kentville Electric Light Company are changing their system from direct current to alternating. At present they give only a midnight service. With the new plant, however, an all-night service will be given. The new plant comprises one 90 kv.a., 3 phase, 60 cycle, 2300 volt, 900 r.p.m. belted generator with exciter and switchboard panel. The company's superintendent, Mr. Baird, is doing the necessary work.

Lethbridge, Alta.

The city of Lethbridge have decided to increase their scale of rates throughout one cent per kw.h.

Listowel, Ont.

A new electrical supply store is being opened on Wallace Street by S. Frey. Mr. Frey will carry a complete stock of electric supplies and fixtures and will also engage in electrical contracting work.

Montreal, Que.

The Southern Canada Power Company are constructing a transmission line, 15 miles long, between Beloeil and St. Hyacinthe, P.Q., being a continuation of the line from Chambly to Beloeil now in use. The entire line will supply the places named in addition to St. Hilaire and the Canadian Explosives Company. At Beloeil an outdoor sub-station of brick and stone, has been erected, in which is installed three

100 kw. Canadian General Electric transformers, with Westinghouse switchboard. It is also proposed to construct at St. Hyacinthe a sub-station, designed for an ultimate capacity of 3,000 kw., in which will be installed, at the present time, three 500 kw. transformers, together with the necessary high and low tension switchgear. The power is transformed at present from 22,000 v. to 2,200 v., but all of the equipment is designed for 50,000 v. service. The line is mounted on wooden poles 35 feet high. J. M. Robertson & Company, Montreal, are the consulting engineers.

According to a circular issued by Mr. L. B. McFarlane, president of the Bell Telephone Company, 247 men, or 6.9 per cent. of the 3,577 male employees have enlisted. Twenty casualties have been reported, 7 killed, 9 wounded or ill, and 4 missing or prisoners. Since the above figures were compiled there have been further enlistments among the company's employees. Mr. McFarlane states that his object in sending out the circular was to encourage others in the company's service to join in the work of defending the country.

The Canadian British Insulated Company, Limited, have gone into voluntary liquidation. The company have a large surplus of assets, but the parent company in England have decided to withdraw, for the present, from the Canadian field so far as having a Canadian office is concerned, owing to the fact that the British company are working under great pressure on war equipment.

The Quebec Streams Commission have awarded the contract for the concrete storage dam on the St. Francis River to Mr. G. Madden, Quebec, for $101,027. There were 17 bids, ranging from that of Mr. Madden to $186,736. Several companies with hydro-electric plants are interested in the scheme, as it will increase the water power on the river during low water periods.

For the purpose of constructing the St. Maurice River dam, designed by the Quebec Streams Commission, the St. Maurice Construction Company, Limited, the contractors, are installing a hydro-electric plant of 1150 horse power, consisting of two units of 575 h.p. each. The power will be developed under 15 feet head. The S. Morgan Smith Company will supply the turbines and the Canadian Westinghouse Company the generators.

The Mayor of Montreal has written to the Electrical Commission suggesting that the inscription on the covers of the manholes of the conduits should be in French and English, instead of in English only as is now the case.

The directors of the Northern Electric Company have offered their old wire and cable factory, corner Guy and St. James Streets, Montreal, for the use of the troops, thus solving the problem of housing the soldiers during the winter. The offer has been accepted and arrangements are being made for converting the factory into a regular barracks, capable of accommodating over 4,000 men. Col. E. W. Wilson has expressed appreciation of the patriotic motives which actuated the directors of the company to place the building, admirably suited for the purpose, at the disposal of the Militia Department.

The Edmonton Power Company, Limited, has been incorporated with a capital stock of $100,000 and head office in Montreal.

Montreal South, Que.

The Town of Montreal South have awarded a contract for the construction of a new street lighting system to Mr. W. G. H. Cam, Montreal. The plans, prepared by the town engineer, Mr. Drinkwater, include the installation of about 54 street lights, 60 watt, 110 volts, over a distance of about three miles, divided into seven districts, each controlled by a Venner time switch. The brackets and wires are to be installed mainly on the Montreal Light, Heat & Power Company's poles.

Nelson, B.C.

Upwards of $15,000 will be expended in Nelson this year by the British Columbia Telephone Company in improvements to the system. Poles are to be removed from the leading thoroughfares and on others the cable system of carrying the wires will be substituted for the open wire system at present in use.

Newmarket, Ont.

The town council has fixed the house lighting rate at 5c. per kw.h. with the usual discounts for prompt payment.

Niagara Falls, Ont.

The superintendent of the electric light department, Mr. G. E. Foster, has recommended alterations in the electric lighting system of Niagara Falls. It is understood Mr. Foster suggests replacing the present arc lights with incandescents.

Ottawa, Ont.

The Dominion Railway Board has issued a majority report granting compulsory connection between independent telephone systems and the Bell Telephone Company for long distance messages. The chairman of the board, Sir Henry Drayton, dissents from this finding on the ground of unfairness to the Bell Telephone Company in certain cases, taking into consideration the heavy investment this company has made in long distance transmission lines.

Owen Sound, Ont.

The village of Holstein recently carried a by-law by a large majority authorizing a contract with the Hydro-electric Power Commission.

Sarnia, Ont.

A by-law will be submitted in the near future asking the authority of the electors to expend some $215,000 in purchasing the plant of the Sarnia Gas and Electric Company and in certain extensions.

Swift Current, Sask.

A by-law has been carried authorizing expenditure of $75,000 for completion of municipal power plant, Swift Current.

St. Johns, P.Q.

The united Councils of St. Johns and Iberville, Que., have under consideration a scheme for lighting the new bridge over the Richelieu River, between St. Johns and Iberville. It is proposed to erect 18 standards, 80 feet apart, on both sides of the bridge, with two lights on each standard. Tenders for the equipment have been called.

St. Lambert, P.Q.

The town of St. Lambert, P.Q., is calling for tenders for the installation of 42 lamp standards, with 6,500 feet of duplex underground cable, terminals, etc. The tenders close on October 4th. Mr. E. Drinkwater is the town engineer.

Toronto, Ont.

The engineers of the Hydro-electric Power Commission of Ontario have submitted to the local government their plans for a hydro development at Queenston. They are designed to utilize the waters of the new Welland Canal.

Vancouver, B.C.

As a measure of economy Vancouver city council was seriously considering the advisability of reducing the expenditure for street lighting by cutting off the current from every second ornamental standard. This brought an offer from the Vancouver Power Company, through general manager Kidd, of the British Columbia Electric Railway Company, who urged that reduction in the number of street lights would give the city a bad advertisement. To meet the council's desire for economy the company agreed to allow a discount of 20 per cent. on the amount covered by the present contract, which will expire on June 30th, 1916. The offer will probably be accepted.

Alternating Current Direct Connected Units

60 CYCLE—3 PHASE

2 400 Kw. General Electric, form A, 550 Volt or 2300 Volt, 48 pole, 150 R.P.M., dir. conn. to 18-in. and 36-in. x 30-in. Buckeye, R.H., heavy duty CC. engines.
1 300 KW. Stanley 600 volt or 2300 volt, inductor type, 164 R.P.M., dir. conn. to 18-in. and 24-in. x 30 in. Russell tandem right hand, 4-valve engine.
1 300 KW. Crocker Wheeler, 600 volt, revolving field, 150 R.P.M., with Buckeye engine.
1 240 KW. General Electric, 480 volt, ATB, form E, 200 R.P.M., dir. conn. to 17½-in. x 21-in. Buckeye heavy duty, piston valve engine.
1 160 KW. Crocker Wheeler, 240 volt, 257 R.P.M., dir. conn. to 15-in. x 17-in. Straight Line engine.
Also smaller sizes.

Alternating Current Belted Dynamos—3 and 2 Phase

1 250 KW. Bullock 2300 or 600 volt., rev. fld., 12 pole, 600 R.P.M., with dir. conn. exciter.
1 200 KVA. Gen. Elec. 2300 or 600 volt, form PB, 10 pole, 720 R.P.M.
1 200 KW. Gen. Elec. 550 volt, ATB-D, 600 R.P.M.
1 200 KW. Westg. 2400 or 600 volt, rev. fld., 600 R.P.M.
1 200 KW. Westg. 2400 or 600 volt, type G, 600 R.P.M.
2 180 KW. Westg. 2300 or 600 volt, rev. fld., 514 R.P.M.
1 120 KW. Westg. 2200 or 550 volt, 720 R.P.M.
1 120 KW. Westg. 2300 or 600 volt, rev. fld., 900 R.P.M.
1 50 KW. Ft. Wayne, 240 volt, TRB, rev. fld., 6 pole, 1200 R.P.M.
1 30 KVA. Westg. 2200 or 550 volt, rev. fld., 1200 R.P.M.
Also smaller sizes.

THE FOREGOING IS, OF NECESSITY, A VERY CONDENSED LIST OF WHAT WE HAVE TO OFFER. SEND FOR OUR COMPLETE LIST OF MOTORS, GENERATORS, ENGINES, AIR COMPRESSORS, HOISTS, ETC.

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FRANK MACGOVERN, Pres.-Gen. Mgr. JOHN MAYER, Jr., Vice-Pres.-Treas.

114 Liberty St., New York City

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Electrical Engineers Equipment Company

711-715 Meridian St., Chicago

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Northern Electric Company, Limited

Tenders

A few dollars spent in advertising your proposals in

The Contract Record

would result in additional competition, which might save your city or town or your client many hundreds of dollars.

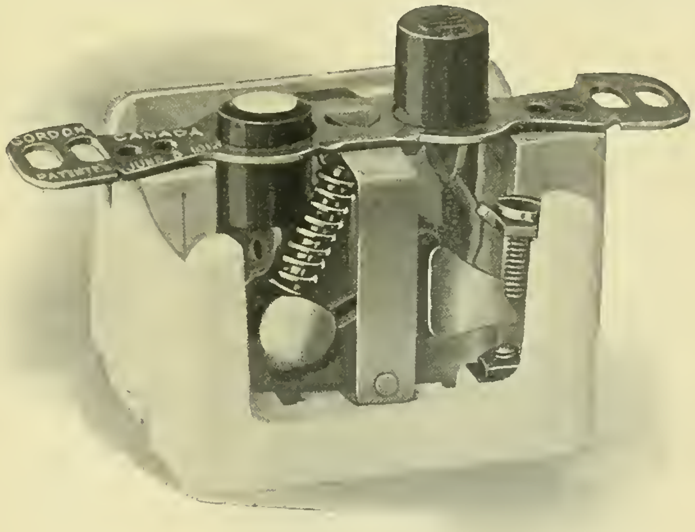
"A Better Switch at a Better Price"

"KING" FLUSH SWITCH

The Only Flush Switch

MADE IN CANADA

that is approved by the Underwriters.



Note the Special Features

The outstanding feature of this switch is its simplicity—only four working parts. This reduces to a minimum all chances of it getting out of order and failing to work. Made in three types—Single Pole, Double Pole and Three-Way.

We Manufacture a Complete Line of Electrical Supplies

including Fuse Plugs, Sockets, Receptacles, Cut-Outs, Rosettes, Switches, etc. These goods are all MADE IN CANADA and are second to none in quality, workmanship and price. It will pay you to get our prices before buying elsewhere.

Send TO-DAY for a Copy of our New Handsomely Illustrated Catalogue.

ELECTRIC SPECIALTY & SUPPLY CO.

TORONTO 20 Adelaide St. West ONTARIO

Vancouver, B. C.

The work of remodelling and extending the fire alarm system in Victoria will be completed by the end of the present month, it is expected. As originally planned 35 alarm boxes were to have been installed but for economical reasons this number had to be reduced to ten—the balance will be added when money is more plentiful. The wiring in the various fire halls has been completed and the switchboard is being set up on the top floor of the new police building. There has been great difficulty, it is said, in securing the necessary material for the switchboard. The usual avenue of slate supply has been checked by the war, and it has been necessary to secure a high grade slate which would stand the requisite polish. Eventually the manufacturers found a suitable substance, it is believed, in the Cambrian stratification of the New York-Vermont line, where are the principal slate quarries in the United States.

Vancouver members of the Canadian Society of Electrical Engineers recently had the pleasure of entertaining a distinguished member of their profession in the person of Mr. R. W. Pope, honorary secretary of the American Institute of Electrical Engineers, who delivered an address before the local society on the evening of September 6th, that was highly instructive along purely technical lines. It was Mr. Pope's second visit to British Columbia, the first being away back in 1866, when he was connected with the Collins' Overland Telegraph Expedition.

The Shull Lumber & Shingle Company, Limited, have installed an electric lighting plant of ample capacity in their new shingle mill on the North Arm of the Fraser River.

Motors For Sale

Electric Motors, Standard Make, New. Will sell cheap for cash. Apply E. F. Knox, 243 College Street, Toronto. Phone College 1374. 19-20

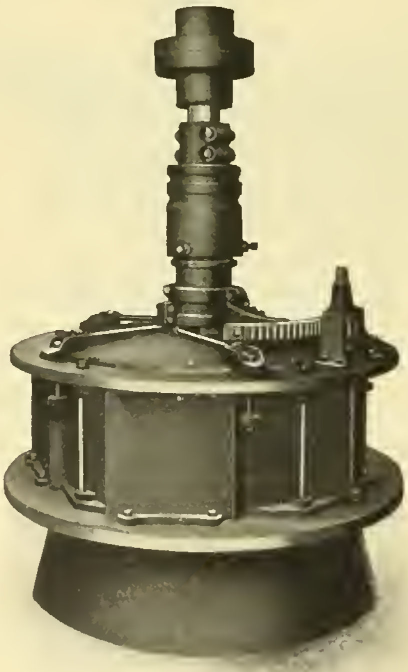
Patent For Sale

The Proprietors of Letters Patent No. 144377 relating to "Method of and apparatus for manufacturing sinking weights for Fishing Tackle" desire to dispose of the patent or to grant License to interested parties at reasonable terms with a view to the adequate working of the patent in Canada.

Inquiries to be addressed to the actual proprietors, Jon Paulssons Fiskredskapsfabrik, Delsbo, Sweden. 19

Positions Wanted

Young man, 26 years, married, Canadian, good practical electrician, good experience in conduit construction, wiring and estimating, thoroughly capable of running small plant. Box 249, Electrical News, Toronto, Ont. 19-20



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Generation, Transmission and Application of Electricity

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What Does It Cost to Cook by Electricity?

A few weeks ago a well-to-do resident in a small Ontario town moved into a new home. Gas was not available and conditions were such that electricity for cooking would have been an ideal arrangement. Yet this householder was not approached on the subject. Left to his own devices he concluded that electricity was "too expensive" and bought a coal-oil range. When, by chance, the question was raised later with this householder as to why he was not cooking with electricity he confessed that he didn't know anything at all about it.

The electric service in this town is supplied by a private company. Is this the way the private companies are looking after their new-business department? This householder stated that his coal-oil bill was "something over a dollar" a month. How does this compare with electricity? Cost figures are not available in the town in question for comparative purposes but there is ample data to show that electricity is cheaper for this householder than coal-oil. For example, we give below a list of figures which have been compiled from a large number of householders in the city of Toronto using Hydro service. The family in question includes two persons only. According to the table herewith the average consumption of such a family in Toronto is 40.5 kw.h. per month. In Toronto this works out at 67.8 cents per person per month or $1.35 per month for this family—no more than the bill for coal-oil and infinitely better from every point of view—sanity, safety, convenience. What arguments can be advanced in favor of coal-oil to offset these? And the table shows that the family of two is decidedly at a disadvantage, as far as consumption is concerned, compared with larger families.

The figures in Table I. exclude all energy for lighting purposes and vary for periods between one month and seven months, averaging about six months.

Table I.

No. of persons in family	No. of families averaged	Kw. hours total	Cost total	Kw. h per person per month	Cost per person per month
2	6	2386	$40.00	40.5	67.8
3	12	2727	63.55	16.0	37.2
4	9	3669	56.89	17.6	27.3
5	6	4705	71.65	27.7	42.1
6	5	4430	77.30	22.4	39.1
7	4	2606	45.15	13.3	23.1
4.3		20523	$354.54	20.5	35.4

The figures in Table II. include the energy consumed for lighting purposes and the amounts shown vary for periods from one month to seven months, averaging about six months.

Table II.

No. of persons in family	No. of families averaged	Kw. h used	Cost Total	Kw.h per person per month
2	6	3065	$68.23	51.9
3	12	5452	133.98	31.9
4	9	6004	145.05	28.9
5	6	6027	122.51	35.5
6	5	5831	129.32	29.5
7	4	3516	79.68	17.9
9	2	1410	45.57	15.1
4.3		31795	$743.44	28.2

Electrical Progress in the Far East

The rapid advance of electrical engineering in China during the last few years, and the growing interest in the possibilities of electrical current for town lighting and industrial power throughout the republic, hold out a promising future for enterprise in this direction, and for the huge trade in machinery and materials involved. Shanghai has a municipal installation with a capacity of 14,000 kw., the plant being of the most modern type, and generally conceded to be the finest in the far east. It is to be noted that extensions up to an additional capacity of 20,000 kw. are planned. Hongkong boasts two electricity supply companies, one having a station with 2,000 kw., Diesel engines and 600 kw. steam engines; the other with 516 kw. engines, to which will be added 1,500 kw. during the current year. In addition, the Hongkong and Whampu Dock Co. has a plant with a capacity of 500 kw., and further plant on order to the extent of 700 kw. At Canton the public supply company uses steam and Diesel engines to an aggregate capacity of 1,540 kw.

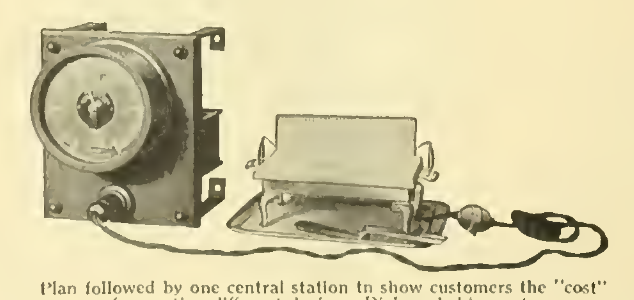
The above are outstanding instances of the progress which is being made, but there are many other installations of scarcely less importance, as, for example, at Soochow, Kiangsu province, where the capacity of the plant is 1,375 kw.; Chang Chow, in the same province; Fatshan, Kwangtung province; Kongmoon, Kwangtung province; Hoihow, Hainan; and also at Tiensin, Shek Ki Heungshan, Pekin, Changsha, Tsingtau, and Macao. Many of these plants, and the list is by no means complete, are of over 1,000 kw., and some are much larger. One British firm alone have installed over 100 steam engines in China, of a total horse-power of nearly 30,000, most of which are used for electricity supply in some 40 different districts. A tendency which set in some

time before the war is the replacing of original German plants by those of British type. The war is certain to give fresh impetus to this tendency, especially as it is now impossible to obtain supplies from Germany. The prospect before importers in regard to the supply of materials is therefore particularly promising, and it is advisable that they should get into touch with British firms of high standing in in order to cope with the rapidly increasing demand.

Public Service Corporation of Quebce

The first meeting of the Board of Directors of the Public Service Corporation of Quebec, subsequent to the organization meetings, was held recently at the office of the company in Montreal. The Board of Directors is composed as follows:—president, J. C. Smith; vice-president, Howard Murray; treasurer, W. S. Hart; John T. Ross, Thomas McDougall; Dr. Milton L. Hersey, Chs. H. Branchaud, Georges Parent, G. Emile Tanguay. Mr. James Wilson is secretary. The plan for improvement of the steam plant on Grant street, Quebec, and the installation of an additional steam turbine unit was approved. The president also reported that the construction of the transmission line from Shawinigan Falls to Quebec was well under way; that a large proportion of the concrete bases for the steel towers had been erected and that everything pointed to a successful completion of the line before the 31st December. The plans of the company look particularly to giving to the city of Quebec a continuous and satisfactory supply of current for lighting and industrial purposes.

Recently a number of Canadian and United States capitalists and engineers visited electrical and allied plants at various points in the province of Quebec. The visit was at the invitation of Mr. J. E. Aldred, president of the Shawinigan Water and Power Company and of the Cedars Rapids Manufacturing and Power Company. Starting from New York, the party visited the factory of the Aluminum Company, at Massena, N. Y., this concern having a contract with the Cedars Rapids company for the purchase of the larger part of the latter's power. From Massena the party travelled to Cedars Rapids and inspected the plant; and from there to Montreal. A special train conveyed the party to Three Rivers, where the Shawinigan company have traction interests, and on to Shawinigan, where the company's plant was looked over. Next, a visit was paid to the new hydro-electric development of the Laurentide Company now under construction at Grand'Mere, and finally the party journeyed to Quebec, to which city the Shawinigan company have secured an entrance through control of the Dorchester Company, and to which a transmission line is now being built from Shawinigan. Among the Montreal visitors were Messrs. Thos. McDougall, Julian C. Smith, Howard Murray, W. S. Hart, Milton Hersey and C. H. Branchaud.



Plan followed by one central station to show customers the "cost" of operating different devices- Dial graded in cents.

If I Were You

The Society for Electrical Development, who have active charge of the campaign for an Electrical Week from November 29 to December 4, offer the following suggestions which may contain some ideas of value to even those who are not immediately interested in boosting the sale of electricity or electrical devices for that particular date.

If I Were a Central Station Manager:

I would begin to plan right now some snappy, novel advertising "stunts." Of course, I would not neglect any present business-getting plans, but I would certainly plan something special for the big affair in November.

I am a great believer in demonstrations, especially during the Christmas shopping season. Indeed, it is fortunate that Electrical Prosperity Week comes at the beginning of this great merchandising period. Shoppers are attracted by demonstrations and they buy.

It might cost more money than I can afford to advertise a demonstration as effectively as I would like to, but I will use the newspapers for the announcement, anyway. Having segregated my city into districts and numbered each one, I would offer a prize of, say, $10 to the commercial representative securing the largest attendance to the demonstration from his own district.

I would work it somewhat in this manner: Monday I would assign to District One, the invitation card being green in color; Tuesday to District Two, the invitation card being pink, and so on during the entire Week, the color of the card and district being changed accordingly.

If I worked for a company in a small city I would modify the foregoing plan, but I would put on a demonstration at all events, and if I did not sell appliances I would put the demonstration on just the same and co-operate with the dealers. It's a good stunt.

Also, I would assist the contractors to install service in stores which haven't got it now, or to make present lighting systems more efficient. Electrical Prosperity Week is going to be a celebration—it can be made so everywhere—and merchants should have better than ordinary lighting to get the best results from their selling efforts. I would get busy with the civic organizations, such as the Chamber of Commerce, and tell the secretary (usually the live wire) all about the Week. I know they will receive me with open arms after they get the letter and literature telling them of the great trade campaign, which is being circulated by the Society.

I would plan right now to offer prizes to school children for the best essays on Electricity, on what it will do. I would support the Electrical Page, if there is one in the local paper. Newspaper advertising will make more business for me.

There is one thing I certainly would do above all, that is to illuminate the front of my offices, as they have never been illuminated before. Then I would have an attractive show window, and keep the inside of the store well lighted, for if I did not keep my place lighted until 11 o'clock or later, I certainly would not be in position to ask others to do so. Yes sir, if I didn't do anything else, I would have my place of business a veritable blaze of light.

I would send in my order to the Society at once for a complete set of its splendid campaign advertising matter—nothing like getting it ordered well in advance. I would begin now to print the Week's design on my bills and on all my stationery. To try honestly, there are so many things I could do—that I can't begin to tell in this space all that could be done.

If I Were a Manufacturer.

I would write a letter to every last one of my salesmen, no matter where they were located, and tell them what Elec-

trical Prosperity Week means to the industry. I would send this letter out from the home office and I would either sign it myself as the president of my company, or my sales manager would sign it.

This letter would urge my salesmen to hustle for business that is bound to come on account of the Week. I would fill it as full of ginger as I could. I would impress them with the importance of this national-wide campaign and the fact that it is the greatest trade movement in history. Then I would present some of the possibilities offered to "clean-up" and follow this up with other letters.

Then I would enclose little leaflets to jobbers, telling them how I was going to help the good cause along, and urging them and the dealers to work for and get benefits from the Week.

But here, I nearly forgot something that is more important, that is, mention the name of the Week, and print my membership emblem or the Week's design in all my advertising matter. In this way I would benefit from the nation-wide publicity the campaign is getting in newspapers and magazines everywhere. I would certainly advertise in the electrical Trade Journals for this event if I never did it again throughout the year, because the Week will surely benefit the manufacturer. Everything that is sold naturally has to be made, and therefore I would surely profit in any event.

If I Were a Jobber:

I would urge my salesmen to think, talk and boost Electrical Prosperity Week. I would, through circular letters, and in every way possible, impress upon them the importance of promoting the success of this great campaign.

I would feature the Week in my house organ, if I had one, and I certainly would advertise it by printing the Week's design in all my advertising copy, no matter where it was printed, and I would certainly advertise it in my electrical Trade Journal.

There are any number of ways I could help the retailers in conducting sales campaigns. I could get literature from the manufacturers which would boost the campaign along, and as this is a very special occasion I think it would be a good idea to get up some special literature of my own, thus co-operating in the movement with profit to myself—and at the same time aid in the development of electrical products.

If I Were a Dealer:

I would pay particular attention to window displays. The show window is the last link in advertising. It shows the prospective customer the article he has read about in magazines and newspapers. A well-lighted, attractive show window is certainly effective in selling goods—and it is really surprising how inexpensive it is to get up one.

I would begin to plan right now some special sales campaigns and emphasize the "shop early" idea for Christmas in all of my advertising, cards and publicity of every description. The Week comes at just the right time for this. I know of so many things I could do to profit that my field is really unlimited.

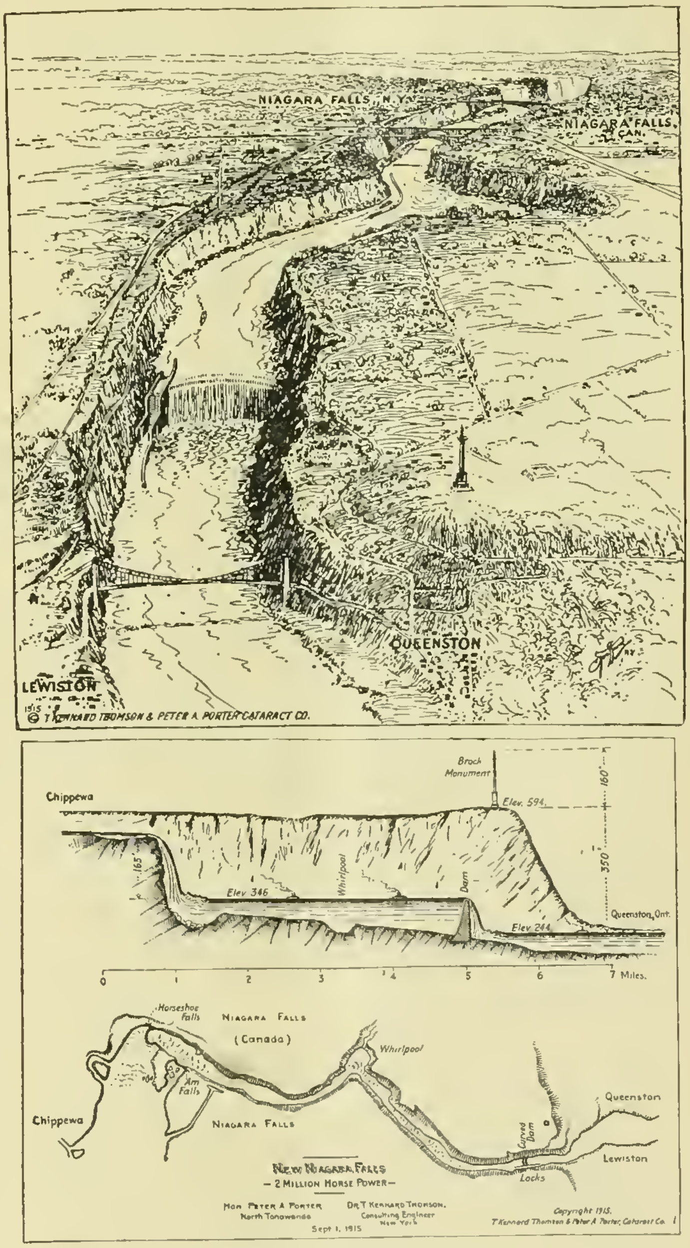
If I Were a Contractor:

I would start right now to line up all the people of my acquaintance and make known to them what Electrical Prosperity Week stands for. I would figure out who should have their houses and places of business wired, and get busy to wage a special campaign for this business. I know my prospects will have their interest awakened by the tremendous publicity the Week is receiving. They will be in a receptive mood to install electric service, or add to their present system.

I would get busy with the secretary of the Chamber of Commerce, tell him what the Week means to our city, to the people of the whole country, and how better lighted streets and stores will help this city to prosper. No one likes a dead town. Electric signs have changed ten o'clock towns into twelve o'clock cities. The electric sign business, as a consequence of this campaign, is going to make some money for contractors—and sign manufacturers, and I would certainly get in on some of it.

The display men in the department stores and similar establishments would aid me to install better window lighting when necessary, for I would have knowledge that the International Association of Display Men—2,500 strong—are back of this movement. They are boosters for the better lighting—and they'll get it. I would want to be the contractor to get the business.

Directors and officers of the Montreal and Southern Counties Railway were elected at the annual meeting last week as follows. Directors, E. J. Chamberlain, Frank Scott, W. H. Biggar, W. H. Ardley, J. A. Yates; President, E. J. Chamberlain; Vice-president and Treasurer, Frank Scott; Secretary, J. A. Yates; Comptroller, W. H. Ardley; General-manager, W. B. Powell.



Bird's eye view and general plan of the proposed lower Niagara River development as recently outlined.

The History of Electrical Development

Past, Present and Future—Outlined by Mr. Samuel Insull Before the Recent San Francisco Convention of the N. E. L. A.

The National Electric Light Association, whose visit to San Francisco and this wonderful exposition we are celebrating to-day, was formed in 1885—thirty years ago. Seven years prior to that, in 1878, the first considerable display of electric lighting was made at the International Exposition held that year in Paris, and it is interesting to note that the great expositions of the world have been, so to speak, mile posts of electrical progress.

As early as 1862, at the London Universal Exhibition, the "Alliance" and other magneto-electric machines, forerunners of the electric generators of the present day, were exposition attractions. The arc lamps of Serrin and others were also shown at that exhibition. At the Paris Exhibition in 1867 there were to be seen magneto-electric machines and also the Siemens dynamo-electric machine, the appearance of which was of great importance in the development of electric lighting during the next two decades. Gramme's dynamo-electric machine was exhibited at Vienna in 1873 and again, in a greatly improved form, at the Paris Exposition in 1878.

The Telephone in 1876

The telephone was the great electrical novelty at the Centennial Exposition in Philadelphia in 1876, but some electric arc lamps were the source of considerable attention on that occasion. The electric lighting of streets and large spaces by means of the arc lamp developed rapidly both in Europe and America during the late seventies and early eighties. Modern electric lighting, however, received its greatest impetus from the development of the high resistance incandescent lamp. Its experimental practicability was demonstrated in 1879 and its commercial importance was inaugurated at the Paris Electrical Exposition of 1881, where an electric generator directly connected to a steam engine was exhibited by the great American inventor, Mr. Thomas A. Edison. It was at an electrical congress held in connection with the Paris Exposition of 1881 that official definitions were given to various electrical units which have since become terms of every-day use.

Storage Battery in 1881

In this same year, 1881, a box of electrical energy, so to speak, and which we would call a storage battery, was carried from Paris to Glasgow by the late Lord Kelvin.

At the great Paris Exposition in 1889, electricity for the first time took a commanding position at a world's fair. Perhaps the greatest attraction on that occasion was Edison's exhibit exploiting the incandescent lamp and illustrating the method of supplying electricity from a central station for electric light and power purposes. It remained, however, for the World's Columbian Exposition held in Chicago in 1893 to recognize electrical development in all of its branches and to provide, probably for the first time at a great international exposition, a building devoted entirely to electrical exhibits and known as the "Electricity Building." Still more important was the fact that at this exposition all the lighting was supplied by means of electricity and that electric motors were used to operate all exhibits requiring power. There were an elevated electric railway, an electric moving sidewalk, and electric launches on the lagoons—so that the intramural transportation by mechanical power was exclusively electrical. The decorative outline lighting of buildings, the electric fountains and electric searchlights made the Columbian Exposition a night spectacle long to be remembered, while the electric service and electrical exhibits generally created an impression of stability and usefulness.

The main mechanical features of the Paris Exposition of 1900, the Pan-American Exposition at Buffalo in 1901, and the Louisiana Purchase Exposition held in St. Louis in 1904 were of an electrical character. At each of these, if my memory serves me correctly, and especially at the St. Louis Exposition, a special building was devoted to electrical exhibits and was known as the Electricity Building, but to so great an extent has the business with which we are associated entered into every branch of industrial, commercial and domestic life that to have provided at the Panama-Pacific International Exposition a distinctive electricity building for electrical exhibits would have deprived many of the other departments of the exposition of some of their most advanced and prized methods of mechanical application.

Eight and a half Million Horse Power

To give you some idea of the development of our great industry, the National Electric Light Association, when formed thirty years ago, only had seventy-one members, whereas to-day its membership is 13,450. The central station light and power industry at the time our Association was formed probably had less than $10,000,000 invested, whereas, at this time there is approximately $2,500,000,000 invested and the gross income amounts to over $350,000,000 per annum. To produce this income central stations having a capacity of between 8,250,000 and 8,500,000 horse-power are employed, of which about one-third are water power stations.

In 1881, when the incandescent electric lighting business first started, only 35,000 incandescent lamps were manufactured in this country and probably not as many in the rest of the world. In 1914, the number of incandescent lamps manufactured in the United States was 110,000,000 and the total world's production in the same year was probably 250,000,000. In the early eighties when the incandescent lamp was first put into commercial use, it consumed almost six times as much electrical energy as the ordinary commercial incandescent lamp of to-day.

First Central Station in '82

The first central-station system for supplying electrical energy for light and power purposes was put into operation at Holborn Viaduct, London, on January 12, 1882, by Mr. Edison's representatives there. This plant, however, was for purely exhibition purposes and could hardly be called a commercial installation. Appleton, Wisconsin, can probably claim credit for starting the first commercial central station installation in the world, on April 20, 1882. This plant was necessarily small. The first large installation erected anywhere in the world was that of the Edison Electric Illuminating Company of New York, which commenced operation in the fall of the same year.

In the early days of the central station lighting business it was assumed that for each square mile of territory occupied, it would be necessary to have a separate power station and a separate distribution system. Partly from a better knowledge which experience brought, partly as the result of the inventive genius of the race, and partly as a result of the necessity of going to a distance for a market, where the electrical energy is developed from water power far removed from where the product is used, it has been

found desirable and economical to concentrate the points of production of electrical energy so that very large quantities are now produced, whether from water power or steam power, in generating stations varying in capacity from 100,000 to 300,000 horse-power. This energy is carried over vast distribution systems extending over areas of varying sizes, depending upon the density of population and density of demand for all classes of domestic, commercial, industrial and agricultural use.

It is a great pleasure to us from the Eastern States to bear tribute to the pioneer work done in California and the neighboring states in the development of electrical systems of long distance transmission and distribution. The company which, as part of its ordinary every-day business, supplies the energy for the marvellous, beautiful and artistic illumination of this exposition is an evidence of the great economic advantage and the great benefits accruing to the communities as well as the investors where large capital is employed in developing the most economical generating and distribution systems of electrical energy.

One Plant Serves 40,000 Square Miles

To give you some idea of the magnitude of this business, the one company in question serves a territory extending from the summit of the Sierras to the Golden Gate, covering 30 different counties of the state having an area of 37,775 square miles and a population of upwards of 1,500,000 people—practically an empire—an area almost as large as Denmark, Holland and Belgium combined and a population probably greater than Rhode Island and Connecticut combined.

How far the massing of production and distribution of energy can be carried depends probably to some extent on the work of the inventor. From an economical point of view, it would seem to me that it will extend wherever there is density of demand, whether for domestic, commercial, industrial, agricultural, mining or transportation purposes; in short, wherever man finds it necessary to employ electrical energy for lighting or power purposes in considerable quantities.

Whilst accurate statistics of the total mechanical horsepower used in the United States are difficult to obtain, it is generally assumed that at the present time there is upwards of 150,000,000 horse-power in use, or say, one and one-half horse-power per capita for the entire population. As but a relatively small percentage of this total is at present handled electrically, either from central stations or electric isolated plants, and as there is every reason why the greater portion of the entire power used should eventually be obtained from central stations, the possibilities of growth of this industry are almost incalculable.

Tremendous Capital Demands

Mr. F. A. Vanderlip, an eminent New York banker, has estimated that upwards of $400,000,000 per year of new capital can be used in the development of the electrical industry for a number of years to come.

Another way of emphasizing the possible growth of the electrical business is to inquire into what relation the coal consumed for electrical purposes bears to the upwards of 500,000,000 tons consumed in the United States for all purposes. We find that only between five and six per cent. of the total coal used is employed in the production of electrical energy, whereas the probability is that eventually one-half to two-thirds of the coal cunsumed will be used for electrical purposes.

Save Quarter Billion Tons of Coal

We are given as a people to talk a great deal about the conservation of our natural resources. The coal supply of the United States is, as I have already stated, being absorbed at the rate of upwards of 500,000,000 tons per annum and the problem of its conservation is one of serious moment, at least to future generations. The production of electrical energy at highly economical generating stations and the bringing into use of the 200,000,000 horsepower of hydroelectric plants, which government experts say are possible of development in this country, would greatly add to the conservation of the coal supply. If all of the energy used in the United States were supplied electrically from central station distribution systems, it is no idle guess to assume that the coal consumption of the country, after allowing for the energy produced from water power, would in all probability be reduced one-half. There is no data available to make any close estimate of the possible saving in this direction, but, judging from the efficiency of the ordinary steam plant, the guess that one-half of the coal consumed could be saved does not seem to me at all wide of the mark. Such a saving would be conservation of natural resources of the highest order.

Concentrate Production

It is only by concentration of production and distribution that low cost of the operating company and consequently low price to the consumer can be obtained. The highest efficiency of operation is attained by an absolute disregard of artificial boundaries created by law, such as municipalities or states. As a rule, the greatest possible liberality in matters of this character has existed in the minds of the law-making bodies throughout this country and the business has been allowed to develop in a natural way. It is probably largely owing to this fact that the central station business has achieved a development in the United States far beyond anything that has been accomplished in the countries of the Old World, where all kinds of restrictions, so far as district and municipal boundaries are concerned, have interfered with the natural economic development of the business. It is hoped that this liberal policy with relation to our industry will continue, as it is only by taking advantage of large production and distribution and of the diversity of demand for our product by customers of different character in different districts where use of our investment takes place at different times, that the greatest average use of our investment can be brought about and consequently the lowest possible cost to all concerned.

Electricity has Revolutionized Modern Life

The establishment of central station electric light and power systems has largely revolutionized modern conditions, whether we look at the matter from a domestic or an industrial point of view. Partly from the development of this business and partly from the development of its allied industry, electric railroads, the introduction of electricity has spread our urban population over wider areas, resulting in healthier and better conditions of living. These two agencies, the central station and the electric car, have brought to our rural populations better means of transportation and cheaper power for manufacturing purposes and are, therefore, helping to solve one of the greatest problems of modern life; namely, the proper care of the rising generation by enabling the worker to establish himself under conditions which will help him to bring up his family with every advantage of open air life in a healthy location.

The annual report of the Department of Telephones of the Province of Saskatchewan for the year ended April 30, 1915, is just to hand. The number of telephone stations is made up as follows. Saskatchewan government stations 15,587; rural systems connecting with government exchanges 6,385; municipal systems 359; independent telephone companies 943, rural stations not connecting with government stations 6,333; total 29,607.

Effective Advertising by Electric Signs

Durable Electric Signs, Better Service, and Practical By-laws—Three Important Factors in Increasing the Electric Sign Business

By Mr. J. G. Arnold

It has become quite an important attraction to visitors coming from the smaller cities to Toronto to see the well illuminated advertising signs in the business centre of the city at night.

This alone is excellent proof that an electric sign is a valuable asset to any place of business. The fact therefore, cannot be overlooked that good electric signs are a benefit to the streets of any city.

It is noticeable that the electric sign industry, like many others, is still lacking in one of the most important factors; that is to say, the maintenance and service given electric signs to-day is not sufficient. It is most imperative that an electric sign, to be attractive and efficient, must be properly maintained.

In some cities the larger corporations have undertaken a system of renting and maintaining electric signs installed for their customers. The value and efficiency of this service, over the regular sales proposition, has proved to be of great advantage to both the user and the manufacturer of electric signs. This is best proven by statistics, showing that the increase of sign business in cities where this method is pursued, has an increase each year of nearly 200 per cent. over other cities where the signs are sold and left to the owners themselves to keep the sign properly cleaned and maintained.

It must also be taken into consideration that maintaining large electric signs requires quite an equipment, which of course, the average business man does not possess. Therefore, his sign becomes neglected and instead of beautifying the street and attracting attention to his place of business, it lessens its attractive appearance as well as its advertising value, and in many instances of this kind, the sign manufacturer is referred to as not being a reliable concern.

That electric advertising has shown a large increase each year should not be considered as proof that this industry has by any means attained its highest efficiency. In these days of rapid progress and the careful attention that is given by advertisers to different kinds of advertising, it seems that both the electric sign manufacturer and his salesmen must consider theirselves as experts in electric advertising.

The business man's lack of knowledge as to details pertaining to an advertising sign should be looked after by the salesman, who should not only consider the fact that he is obtaining an order, but he must go further and be satisfied that the sign he is to install for a customer is in keeping with his business, and be confident it will bring satisfactory results to more than reimburse him for the expenditure.

The by-laws pertaining to overhanging electric signs in most of the cities in Canada is now very satisfactory to the electric sign industry. It seems with efficient salesmen, signs well manufactured and properly maintained, electric sign

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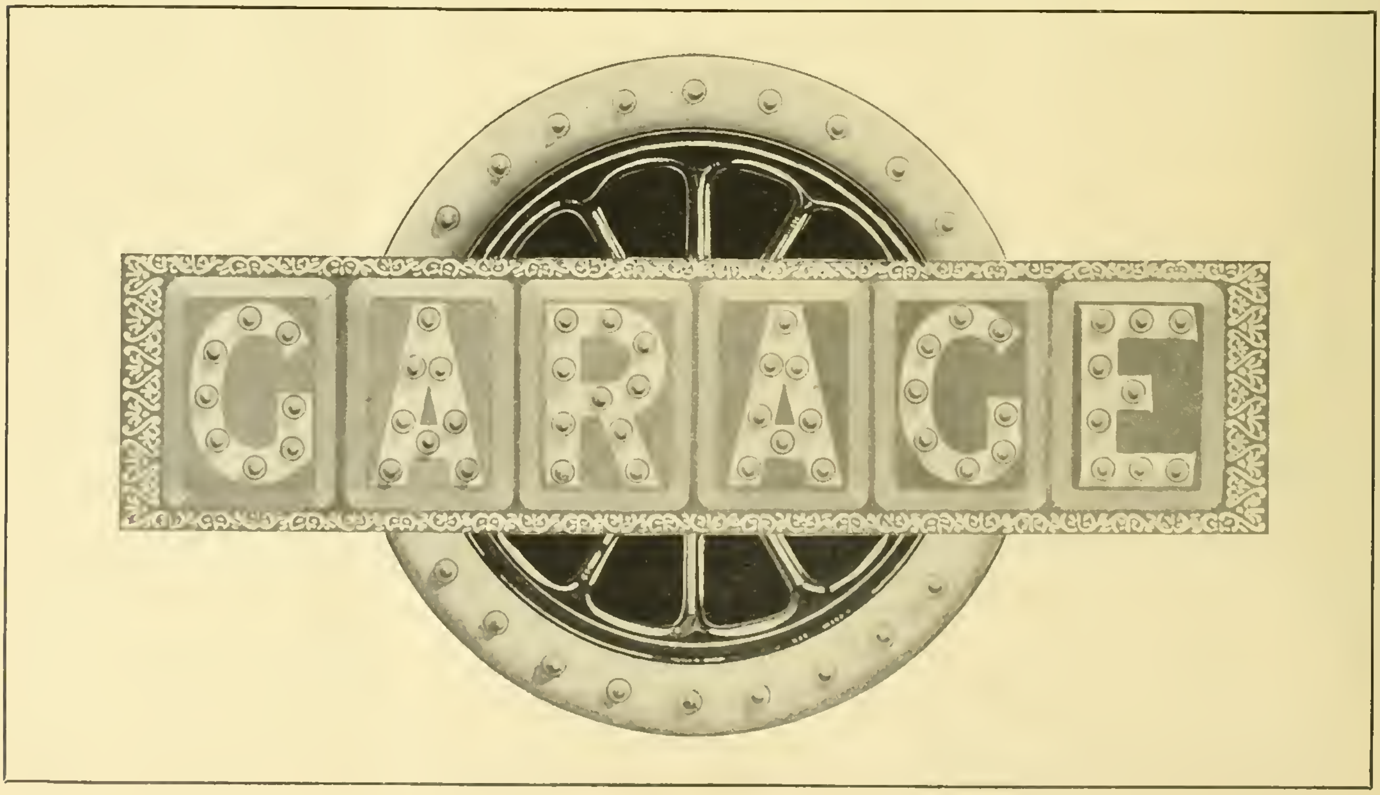
As an example of the thoroughness with which the United States territory is being worked over in connection with Electrical Prosperity week it is of interest to note that during the past week letters were sent out by the Society for Electrical Development to mayors of every town of over 5,000 inhabitants and also to some two thousand six hundred Chambers of Commerce inviting them to take part, officially, in the activities of the campaign. The greatest enthusiasm is shown all over the country.



The Trend of Recent Electrical Progress

A brief review of the past with a conservative prophecy of what the future has in store—progress, stability and permanence

By Mr. P. M. Lincoln*

It has occurred to me that in my address on this occasion it might be well to trace the progress of some of the developments and practises that have marked the path that the electrical engineer has traversed in the past, with a view of obtaining some idea, possibly, as to whither these paths may lead us in the future. Insofar as this method incorporates a review of the past it presents no particular difficulty; but when it involves a prognostication of what a continuation along any particular line of development will finally lead to, it delves somewhat into the realms of prophecy. I realize full well that anyone who attempts to deal in prophecy among the inventions and developments of this day and age is running a grave risk, and I therefore do not propose to wander far from what I conceive that the trend of present development will carry us toward in the future.

Highest Efficiency

In the matter of efficiency, it has always been recognized that electrical apparatus is in a class by itself. Mechanical energy can be converted into electrical by a generator, or vice versa, by a motor, at an efficiency ranging up to as high as 97 per cent. or even more in the most favorable cases. I think it is a safe statement to say that the average efficiency of the conversion of mechanical energy into electrical by generators, or electrical energy into mechanical by motors, including all sizes under actual operating conditions, will reach 90 per cent. There are, of course, many cases where the efficiencies are lower than 90 per cent. On the other hand, there are many cases where the conversion is carried on at much higher efficiencies, and I believe that the assumption of 90 per cent. as an average figure is not far from the truth. Owing to the fact that the size of the average electrical generator is much greater than that of the average motor and that it is possible to operate the generator at higher average loads than in the case of the motor, it must be apparent that the average efficiency in converting mechanical energy into electrical energy is higher than in the reconversion of this electrical energy back into mechanical. The average generator efficiency is undoubtedly well above 90 per cent., while it is doubtful if the average motor reaches so high a figure. However, the general conclusion I would draw from these figures is not modified by this difference between generator and motor. This conclusion, which must be apparent to anyone, is that no development of a revolutionary character can be looked for in this respect. Our ability to convert mechanical energy into electrical, or vice versa, has reached so high a value that even if we could obtain perfection itself we could add only a matter of 10 per cent. to what we have already accomplished. This conclusion must hold unless the law of conservation of energy is revoked, and I am not predicting any suspension of that law.

When we come to deal with the efficiencies by which electrical energy in one form is transformed into electrical energy of another form, efficiencies are found to be still higher. The efficiencies of some of our larger transformers, for instance, exceed 99 per cent. The synchronous converter, in which alternating current is changed into direct, attains efficiencies approaching 98 per cent. It is evident that perfection itself could not add greatly to existing performances and hence nothing revolutionary may be expected along this line in the future.

When we come to consider the prime mover, we find a marvellous improvement in recent years. Taking up first the water-wheel, the early attempts to develop power at Niagara Falls constitute a significant commentary upon the status of the waterwheel at that time (the late 60's and the early 70's). About that time the building of what is now known as the Schoellkopf canal at Niagara Falls made available a head of about 215 feet at the edge of the cliff below the falls on the American side. Of this 215-ft. head, these earliest wheels used only some 15 or 20 ft. for some of the least progressive, and from there up to possibly 40 or 50 ft. for the more progressive. After passing through the wheels under this head, the water was then discharged at the face of the cliff and fell uselessly for the remainder of the distance, much to the detriment of the scenic beauty of the bank. And not only was it impossible at that time to obtain waterwheels that would work under more than these very limited heads, but the efficiencies of such as were used were very far below those attainable now. To-day, waterwheels have no limit in head, except that imposed by the strength of available materials, and efficiencies ranging up to 90 per cent. are expected as matters of course. Improvements in waterwheel design will, of course, continue, but perfection itself would add but a matter of 10 per cent. to the best of our modern practice, and not to exceed 20 per cent. to 25 per cent. to the worst. Therefore, in waterwheels, as well as in motor and generator practice, we are approaching the limits set by natural laws almost as closely as human ingenuity can be expected to attain. No startling or record-breaking developments need be expected along these lines so long as the law of conservation of energy holds.

The Steam Turbine

In thermodynamic engines, too, the last few years have seen marvellous improvement. The reciprocating engine of Watt has largely given place in recent years to the steam turbine, and the use of the turbine has enabled us to attain efficiencies in thermodynamic conversion that were out of the question with the reciprocating engine of Watt. In the thermodynamic conversion the law of conservation of energy takes a peculiar form. No conceivable method of thermodynamic conversion can begin to transform all of the energy contained in a lump of coal, for instance, into dynamic or mechanical form. If the heat contained in the coal is used to heat a fluid and that fluid is used in a thermodynamic engine, the maximum mechanical energy that can be taken from that engine can bear no greater ratio to the total heat imparted by the fuel to the fluid than the actual range of temperature used in the engine does to the maximum absolute temperature of the fluid as it enters the engine. The efficiency which would result by the use of this ratio of temperature ranges is that which would result if what is known as the "Rankine cycle efficiency" were 100 per cent. Some of the best of our modern steam turbines have attained to as high as 75 per cent.—or possibly a little more—of this Rankine cycle efficiency. In these most perfect engines, therefore, perfection itself would not add more than 25 per cent. or such a matter. It should be particularly borne in mind that this statement is true only of the best of modern practice. It is not true that the average of modern practice

* President A. I. E. E. before annual convention.

attains anywhere near this degree of perfection. It is only with prime movers of the largest size and most modern design and construction that so close an approach to the ideal can be attained. As capacity is reduced it becomes rapidly more and more difficult to attain the higher degrees of economy in thermodynamic machines. This must always remain one of the potent factors in the economics of power supply. It is, and undoubtedly always will be, one of the fundamental reasons why central station supply of electric service must prevail as against isolated plant supply for the same service. The central station can, of course, use units which are very large in comparison, and can be worked at much higher average loads than must necessarily be the case with an isolated plant.

One obvious means that has been suggested to improve the efficiency of the thermodynamic engine is to increase the temperature range through which the working fluid is used. When using water or steam as the fluid in our heat engine, there are certain practical limitations to the temperature range which is available and the temperature range cannot be materially extended over the best of modern practice. The only two ways to extend this temperature range when using steam are to increase the superheat or increase the pressure. Increasing the superheat over the best modern practice does not promise results commensurate with the expenditure of heat to obtain this superheat, since increasing the temperature at one end of the heat cycle simply involves a loss in the efficiency at the other end. There is a rather definite limit to superheating of steam beyond which it is useless to go. Increasing the steam pressure does promise results, and it is probable that the tendencies for the future developments in thermodynamic engines will be toward these higher steam pressures.

Mercury as Working Fluid

Another promising method of increasing temperature range is that to which attention has been called during the last year or two by Mr. W. L. R. Emmet, of Schenectady. He has called attention to the advantages of using mercury as the working fluid in a heat engine for temperature ranges above those available with steam. After working the mercury through a given temperature range, the heat remaining in the mercury is transferred to water and the steam thus made available is again worked through a lower temperature range. The advantages of this are that the steam is in practically all respects the same as in standard steam turbine practice and the mercury cycle is closely similar to the steam. Additional energy is made available from the same amount of initial heat, due to the greater temperature range obtainable by the use of the mercury. The main disadvantage is the poisonous nature of mercury vapor and the difficulty of absolutely preventing its leakage at the high pressures and temperatures of the mercury boiler. These practical difficulties make it too early to predict whether or not this method will work out as a feasible solution of the thermodynamic engine problem. However, it can be said that without some such method or device, the future is apt to bring no revolutionary improvements in thermodynamic engines over the best of modern practice. Improvements, of course, will undoubtedly continue to take place, but it cannot be hoped that the improvements of the future will be of the same revolutionary character as the improvements in the thermodynamic engine which have taken place within the last 10 or 15 years. Here again we are approaching so close to the law of conservation of energy that it is safe to make a prediction of this nature.

Capacity of Units Unlimited

In the matter of size and capacity of generating units, it can safely be said that this is a consideration that will hereafter be fixed by the conditions to be met and not by any inherent limitation in our ability to produce units of any desired output. We now have units of 30,000 kw. capacity in service and still larger ones projected, and no limitations of design or material appear of such a nature as to place a stop to further progress along the same line.

At Omaha, in June, 1898, the then president of our Institute, Dr. A. E. Kennelly, made an inaugural address upon the topic, "The Present Status of Electrical Engineering." This address constitutes a very convenient milestone by which to judge our progress since that time, and in this address I will take the liberty of quoting freely from this 1898 address of Past President Kennelly. In the matter of generator sizes, he says, "In 1884 a 50-kw. dynamo was considered a large machine, while a 100-kw. Edison steam dynamo was justly called a 'jumbo.' At present the largest size of generator built or building is of 4600-kw. capacity." In the fourteen years from 1884 to 1898 the maximum size of generator therefore increased 46-fold, while in the seventeen years since that time, the increase has only been about 7-fold While the increase in capacity therefore has been a marked one, the rate of increase has not been so rapid during the last 17 years as it was in the previous 14 years, a result which naturally might have been anticipated. The future will undoubtedly continue to produce larger and larger capacity machines, the limit as to size being dictated by plant capacity and economic considerations and not by any inability to produce the larger sizes.

Decreased Cost of Apparatus

In the matter of selling price of such apparatus the following extract from Kennelly in 1898 may be of interest: "The price of dynamos in 1882 was about 20 cents per watt of output, while dynamos of similar running speed for comparatively small sizes without switchboards now cost about 2 cents per watt." The speed and size of these units is not mentioned, but it may be said in comparison that nowadays prices are frequently quoted below one-half cent per watt. In this respect again, the improvement in the last 17 years has not been so marked as it was in the 14 years previous, a result that is only to be expected. In the next succeeding period it is probable that a still smaller degree of improvement will occur. We are approaching a saturation point in this respect.

It may be well to point out some of the reasons for this approach to saturation in the matter of costs. The two fundamental costs of electrical apparatus are those of labor and material. In regard to the item of labor, I submit that it is safe to predict that the tendency for the future will be for the cost of labor to increase rather than decrease. Economies in the use of labor will undoubtedly take place by the introduction of the methods of scientific management, etc., but these need not be expected to be revolutionary in character so far as cost of apparatus is concerned. The tendency of the labor item will unquestionably be toward appreciation rather than depreciation.

In regard to the item of material, modern design has approached very close to the physical limits of available materials. Take, for instance, the property of permeability possessed by irons. With higher permeability, making available greater flux densities, the cost of electrical apparatus might be considerably reduced. That the future will bring some improvement in this respect is unquestionable; but it is further highly improbable that this improvement will be of such a revolutionary character as to cause any sweeping change in the cost of electrical apparatus.

(Concluded in Nov. 1 issue)

The township council of Brantford township have passed a by-law authorizing an agreement with the Hydro-electric Power Commission of Ontario for a supply of light and power.

Electric Railways

Railway Equipment for 5000 Volts, D.C.—A Description of the Experimental Line of the Michigan Traction Co.

By Mr. Clarence Ranshaw

On June 1st, 1915, about 2.00 a.m., 5,000 volt direct current was applied for the first time to the motors and control installed by the Westinghouse Electric & Mfg. Co. for a service test of 6 months or a year on its Grass Lake and Wolf Lake Divisions. It is expected that this event will prove a memorable one in the list of important contributions toward advancing the art of electric railroading. While there were a few wrong connections and adjustments at the start, as is always the case in the initial operation of any new equipment, these were of a minor nature and were easily overcome; the car has now made over 3,000 miles in commercial service. A description of equipment and of the reasons leading to its installation are given in the following article.

In the use of direct current for electric railways, the trolley voltage of 600, so long considered the limit, has, during the past few years been increased to 1,200 and then to 1,500 volts. The lines where this was first done operated with such universal success that these voltages quickly became common and are now firmly established as standards for interurban work. This development has been of great importance to the art of electrical railroading, effecting essential economies in the cost of construction and operation and making possible the handling of heavier train units on light railway lines.

So few were the difficulties experienced in building and operating apparatus for 1,200 and 1,500 volts and so similar to those for 600 volt apparatus were the requirements found to be, that the probable success of further increases in voltage was quickly foreseen. For interurban lines, however, so

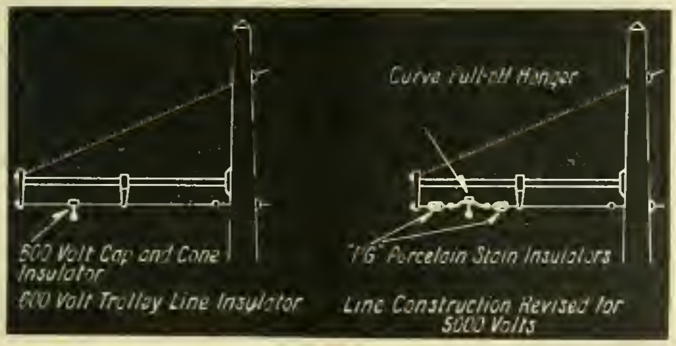


Fig. 1.

great a mileage can be operated economically at 1,200 and 1,500 volts and these voltages lend themselves so readily to the interchangeable operation of the same cars on 600 volts also, that no further increases seemed necessary. For heavy electric traction, though, even a voltage leaves much to be desired and the increasing interest in this branch of the art led to several installations at 2,400 volts. Here again, it was at once apparent that even at 2,400 volts, the limiting d. c. trolley voltage had not yet been reached.

The next step on a commercial basis was the electrification of the Chicago, Milwaukee & St. Paul Railway, not yet in operation which will use a trolley voltage of 3,000. Even this voltage while it will no doubt give excellent results in

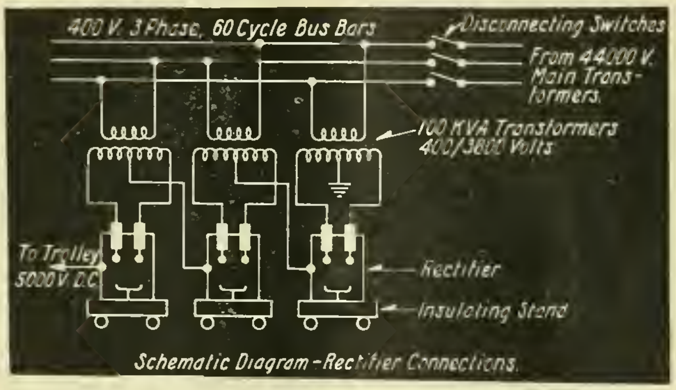


Fig. 2.

the case at hand, is not sufficiently high to eliminate current collection from among the serious problems in the design of large locomotives as is done by the use of 11,000 volts a. c. or to hold the number of substations and the cost of line copper within the desired bounds.

With direct current railway apparatus at this stage of its development, it appeared to the engineers of the Westinghouse company studying the situation, that railway apparatus for 5,000 volts d. c. might be entirely feasible. It also appeared that with practical apparatus for this voltage available, the problems of distributing and collecting the necessary power for the largest locomotives likely to be required could be readily solved, so that further increases in voltage would then be unnecessary. It was realized from experience with this use of 1,200 and 1,500 volts that an unnecessary multiplicity of voltages, with comparatively slight difference between them, tended to lead away from the broad ideas of standardization which have heretofore proved so valuable to American railroads and that such a multiplicity of voltages thus tended to handicap the industry. It was evident, therefore, that in view of the tendency toward high voltages d. c. for certain classes of electrification it was desirable to determine as quickly as possible whether apparatus for use at 5,000 volts was practicable or not and if so, to adopt it as soon as possible as a standard instead of increasing the voltage by small steps in each successive installation.

While a great deal of information can of course be gathered from factory tests, it was obvious that actual commercial service was the only really satisfactory way in which the success of railway apparatus, differing in so many particulars from previous practice, could be conclusively demon-

strated and it was to secure such a demonstration that the experimental equipment described was installed.

The Line

Of the lines of the Michigan United Traction Co. the section from Jackson to Grass Lake is 11.4 miles long, 2 miles of which is in the city of Jackson itself, over tracks of the 500 volt city lines. At Wolf Lake Junction, 9.24 miles from the Jackson terminal a branch extends 2.71 miles to Wolf Lake at which there is a small colony of summer cottages.

From the latter part of May to the latter part of September the service requires two cars, except for one trip

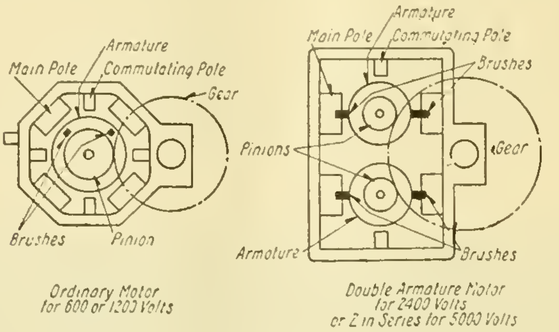


Fig. 3.

late at night. Opportunities for running the 5,000 volt car during this period therefore, were somewhat limited. During the remainder of the year, however, a single car service is sufficient and when this goes into effect in the near future, it is expected that the high voltage car will perform practically the entire service and thus be given a thorough test.

In revising the 600 volt trolley line for use on 5,000 volts, the construction was modified as shown in Fig. 1. It will be seen that the revision consisted merely in removing the usual 600 volt insulator and replacing it by a type P.G. porcelain strain insulator located in the span wire at each side.

The 5,000 volt trolley is separated from the 500 volt one at the outskirts of Jackson, by an insulated section of slightly greater length than the car. This is normally dead, but by holding a long rope attached to an air brake switch on an adjacent pole, it can be energized with 5,000 volt current. When the car is coming from the 500 volt line, it is stopped on the dead section until the changeover switch has been thrown. By holding the rope, the section is then energized with 5,000 volt power until the car has left it, after which the rope is released and the section again becomes dead. When the car is coming from the 5,000 volt line, it coasts entirely over the insulation section to the 500 volt line and the changeover switch is then placed in the 500 volt position.

The Sub-station

Direct current power at 5,000 volts for operating the car is obtained from steel tank, mercury vapor converters located in the sub-station at Grass Lake, which supplies 600 volt power for the normal operation of the line and for operating a neighboring line of the Detroit United Railways. Three of these converters, with their a. c. terminals connected one set to each phase of the 400 volt, 3 phase, 60 cycle bus bars of the station and their d. c. terminals connected in series as shown in Fig. 2, are used for normal operation and a fourth is installed as a spare unit.

The use of vapor converters for supplying power is in no way an essential part of the test for the 5,000 volt equipment but is an entirely separate experiment. These converters seemed to afford the most convenient and inexpensive means for obtaining power at the desired voltage, particularly in view of the small space available in the station for the installation of additional apparatus, and they were adopted for this reason. As it was, the transformers had to be located out of doors and the converters themselves crowded into an out-of-the-way corner. This installation is the first in which vapor converters have been connected in this way to a 3-phase circuit or have been used to produce so high a direct current voltage. It is also the first case in which converters of the steel tank type have been operated from 60 cycle power.

The Car

The most interesting and important items of the installation are of course the car and its equipment. Car No. 62 is a standard wooden interurban car, approximately 56 ft. long overall and 30 ft. 9 in. between bolster centres, weighing approximately 40 tons complete with equipment but without load. The equipment consists of 4 motors, each rated at 100 h.p., 2,400 volts, connected two in series for operating on 5,000 volts, together with a suitable outfit of type HB unit switch control. Operation in the city of Jackson is provided for by a changeover switch which re-groups the motors for the service.

The gearing is such that the car attains a free running speed on the level of about 48 miles per hour on 5,000 volts, or 20 miles per hour on 500 volts. When running at full speed on the former voltage, it requires approximately 30 amperes with a maximum during acceleration of about 2½ times this amount. The car is particularly "snappy" in its action and accelerates rapidly yet smoothly on both voltages.

The Motors

The use of so high a voltage as 2,500 at the terminals of each motor is made possible by the fact that the motors are of the double armature type. In this type of motor each field frame contains two entirely separate armatures with independent pinions which are connected together by meshing in a common gear. While the voltage at the terminals of a motor is 2,500 therefore, that on any one commutator is limited to 1,250.

This principle, perhaps, will be more clearly understood by reference to the sketches, Fig. 3, where the arrangement of this type of motor as compared to the usual 600 or 1,200 volt railway motor is shown in diagramatic form. While this motor looks extremely deep as compared to the more nearly circular forms in general use, there was no difficulty in mounting it on 37-in. wheels with entirely satisfactory clearance. Ac-

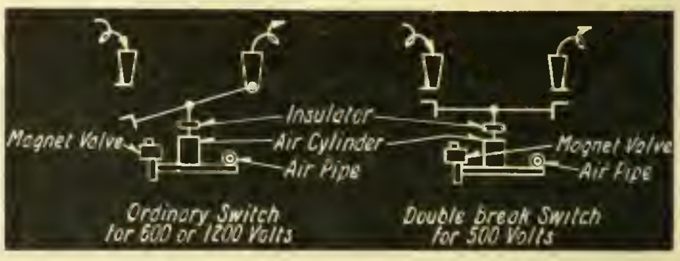


Fig. 4.

cess to the upper brushes is obtained by the usual commutator lid at the top of the motor. The lower ones can be easily reached from a pit through a similar opening at the bottom.

The Control

Opening and closing of the 5,000 volt circuit is accomplished by switches of the double break type so that a large number of circuit opening breaks in series is obtained with a comparatively small number of switches. The general arrangement of these switches as compared with the single break electro-pneumatic switches ordinarily employed for 600 or 1,200 volt equipments is shown in diagramatic form

in sketch, Fig. 4. Certain additional switches which are never subjected to high voltage, are of the ordinary 600 volt type.

Power for operating the air compressor, arc headlight, car lights and control circuits is obtained from a 150 volt, storage battery, which is charged by being connected in series with the motors during 5,000 volt operation and by being connected to the trolley through a resistance during 500 volt operation. The battery is protected from the action of heavy peak loads by a set of counter e.m.f. cells connected in parallel with it. These act as a safety valve and shunt off some of the motor current from the battery in case this exceeds the safe capacity of the latter. Experience has proven that in the case of this equipment the battery is of such ample size that the counter e.m.f. cells are really not necessary and could be omitted.

Overload protection is afforded, as is usual with equipments of unit switch control, by an overload trip relay. This relay, on being operated, causes all of the main circuit breaking switches of equipment to open and thus cut off power. The changeover switch for modifying the connection for 500 volt operation is of the oil insulated type and is manually operated by a suitable lever at the side of the car. The trolleys are of the ordinary wheel type; each is mounted on a suitable insulated base. Protection in handling the trolleys is afforded by a long wooden insulator inserted in each of the ropes. The reverser, resistance, master controllers, control switches, etc., are of the usual type and require no particular comments.

The Results and Conclusions

The development of this equipment along the lines described has been so straightforward and difficulties of every kind have been so noticeable by their absence that the case seems a most remarkable one. Operating as circumstances permitted, for one or two round trips per night, since the initial trial June 1st, the car has now made approximately 3,000 miles with a record of 100 per cent. The equipment

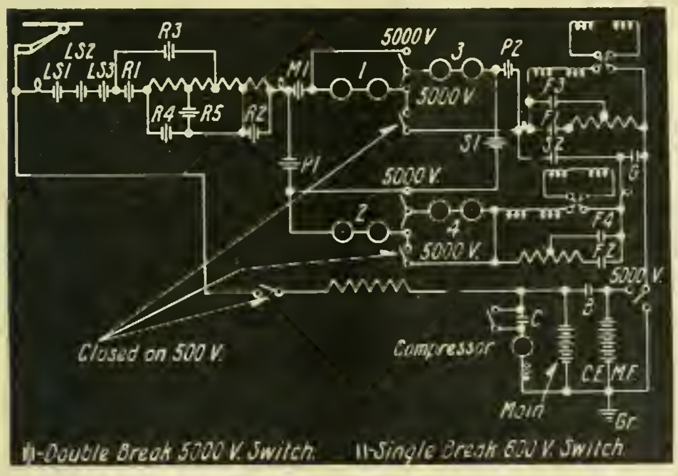


Fig. 5.

has not required repairs of any kind, nor even cleaning, and it has not given a minute's trouble. The commutators of the motors have taken on an excellent polish and many of the switches in the control look as though they had never been subjected to current. Owing to the intermittent running which has been necessary so far, the mileage is of course small, but for the class of troubles which would be most expected on such an equipment, intermittent periods of running and of standing without attention, probably afford as severe a test in many ways as a much greater mileage made by more continuous operation.

Without any particular effort to secure small dimensions or light weight, it has been easily possible to mount the apparatus on this small car without crowding and without placing any parts under the platforms. The weight of the complete motors is not excessive and the armatures are particularly small in diameter and light in weight. Commutators and brushes are reduced to a minimum so that at least two of the ideal characteristics for railway motors have been thus secured. The high voltage switches are small in dimensions and the entire control equipment is reasonable in weight and moderate in its space requirements.

While it might be expected that in handling current at so high a voltage excessive arcing would result, it has been found that on account of the extremely small currents required and the greater number of brakes in series, the results are just the opposite. With the covers of the switch groups removed, the car locked by the brakes, and the control thrown on and off, the arcing at the switches on this car with 5,000 volts on the trolley is noticeably less than when a 600 volt car is handled in the same way.

An incidental effect of considerable interest is the operation of the car lights and auxiliary circuits from a storage battery, so that a brilliant uniform illumination is secured at all times. Until the crews became used to this feature, it sometimes led to amusing results on account of the trolley coming off of the wire and the men not noticing it because the lights continued to burn.

One of the fundamental requirements of any system of electrification, in order that it may be generally applicable with best results, is that it shall be suitable for operating small multiple unit cars as well as large locomotive units. It is obvious from this installation that the 5,000 volt d. c. system can readily meet this requirement, as the present car and equipment is smaller than it has heretofore been possible to secure even for 2,400 volt service.

Order of Commissioner Robson re Measures of Prevention of Electrolysis Damage to Underground Cables and Mains in City of Winnipeg

The order of Commissioner Robson in the matter of the application of the city of Winnipeg to compel the Winnipeg Electric Railway Company to establish proper measures for the prevention of damage to the underground cables and the mains by electrolysis by electrical currents from the electric railway system of the company is being appealed on the ground of lack of jurisdiction of the Commission. Commissioner Robson's order reads as follows:—

(1) Every rail joint in the tracks of the electric railway system of the said company shall be so constructed and maintained that its resistance does not exceed the resistance of eight (8) feet of continuous rail. Tests of the resistance of rail joints shall be made and recorded at least once every year, and when defective joints are found they shall be promptly repaired.

(2) The two rails of every single track in the said system, and the four rails of every double track, shall be maintained adequately cross-bonded, and all special track work shall be spanned by copper wire jumpers of adequate current-carrying capacity.

(3) All conductors which connect the tracks of the electric railways in the said system to the direct-current supply stations shall be insulated from the earth.

(4) No metallic connections shall be permitted by the said company in its system between water, gas or other underground pipes and any part of the electric circuit of the electric railway.

(5) The rails or other metallic conductors forming parts of current-carrying electric circuits of the said electric railway system, which are not insulated from earth, shall be designed, constructed, operated and maintained, so that the

average potential difference during any ten (10) consecutive minutes between any two points one thousand (1000) feet or less apart on said rails or other metallic conductors will not exceed one (1) volt, and, further, so that the average potential difference during any ten (10) consecutive minutes between any two points more than one thousand (1000) feet apart on said rails or other metallic conductors within the area comprised by Winnipeg (including Elmwood) and St. Boniface, will not exceed seven (7) volts, (approximately the value adopted by the British Board of Trade).

On account of the concentration and great importance of the underground structures in the neighborhood of the corner of Portage Avenue and Main Street, Winnipeg, all feeders connecting to the tracks within a radius of fifteen hundred feet from the said corner shall be so proportioned as to maintain their connection points in the tracks at the same or slightly lower potential than the tracks at the said corner during peak load. Owing to the proximity of the city water-works, and of the important water main leading to the said works, to Sub-station No. 8 on Logan Avenue, at McPhillips Street, all feeders from the said station to the tracks shall be proportioned for substantially the same voltage drop during peak load. The track voltage requirements of this recommendation are to apply only to normal operating conditions on a business day, and not to occasional abnormal conditions in street railway traffic brought about, for example, by fires, storms, or holiday crowds. If at any time such difference of potential exceeds the above the company shall take immediate steps to bring it below such limit.

(6) Potential wires insulated from earth shall be installed by the company in the district of every sub-station of the company whereby contact may be made to the tracks at each point where a return feeder from this station connects to the tracks, at the feeding limits of each sub-station on the principal track lines where these terminate within the limits of Winnipeg (including Elmwood) and St. Boniface, and at the points where principal track lines cross the limits comprising Winnipeg (including Elmwood) and St. Boniface. These potential wires shall terminate in the sub-stations in such a way that they can be conveniently connected to an indicating volt-meter and to a 24-hour recording voltmeter. One voltmeter of each type shall be provided for each direct-current supply station, so arranged that the potential difference between any two of the above described points in the track system can be measured or automatically recorded. A potential wire shall also be connected to a nearby water pipe by means of which the potential of the negative bus-bar referred to earth may be measured or recorded.

Tests to be Made

(7) By means of the potential wires and voltmeters provided for in clause (6) above, the following measurements and records shall be obtained: The average potential difference between the tracks at a feeder connection point near the sub-station and each other feeder connection point, shall be determined from readings of the indicating voltmeter taken and recorded for a period of about five minutes during the peak load hour, once every month. From such test the point in the tracks which is at the lowest potential shall be determined. A twenty-four-hour record of the potential difference between each point in the tracks at the feeding limits or at the city boundary and the tracks at the point of lowest potential shall then be determined once every month, on a normal business day. The potential difference between the negative bus-bar and a nearby city water pipe shall also be obtained at least once every day during peak load. If this potential difference should fall at any time to such a low value as to indicate grounding of the negative bus-bar, steps shall be taken by the said company to remove the ground connection.

(8) All records of the tests described in the foregoing clauses, as well as the recording meters and meter charts shall be open to inspection from time to time by an authorized representative of the Commission. True copies of all records, as soon as completed, shall be forwarded by the company to this Commission, as also recording meter charts, within twenty-four hours after the taking of such records and charts.

(9) After the work required by Clauses 1, 2, 3, 4, 5 and 6 of this order has been done, in every case all drainage connections from underground lead cable sheaths to railway return circuit in Winnipeg, shall in every instance be opened and kept open, and tests of the potential of these cable sheaths referred to other structures and of current on the cable sheaths, shall (on twenty-four hours' written notice to the owner of such cable sheaths of the time and place at which the test is to be made), be made by the company to determine the electrolysis condition of such cable sheaths. If, in such case, cable sheaths shall be found to require additional protection, a limited amount of electrical drainage may be applied by the company upon application to this Commission on notice to the owner of the cable sheath, and subject to such directions as may be then given by this Commission. Such drainage connections must be arranged to apply equally to all of the underground cable systems, so as to avoid setting up serious potential differences between the lead sheaths of the different cable systems. They must also be so arranged and maintained as to drain off the least current consistent with the complete protection of the cables and without setting up dangerous voltages to other underground structures. A suitable fuse, a knife switch, and an ammeter, shall be installed in each drainage connection, and daily readings of the current drained from the cables during the peak load hour shall be obtained and recorded. The drainage connection must be opened whenever the station is not in operation.

In Future Construction Work

(10) In future constructions and reconstructions of direct current electric railways employing the running tracks as part of the electric circuit, such track construction shall be employed, in addition to that already required by the previous clauses, as will give the greatest practicable resistance between tracks and earth for the existing conditions. Without limiting the foregoing this must be done particularly where such railways cross or run close to underground pipe or cable lines.

(11) In future constructions or reconstructions by the company (within the Province of Manitoba, but excepting the cities of Winnipeg and St. Boniface, which are covered by the previous clauses) of direct current electric railways employing the running tracks as part of the electric circuit, Clauses numbers 1, 2, 3 and 4 shall be complied with by the company, and, in addition, such track construction shall be employed by the company as will give the greatest practicable resistance between tracks and earth in the existing conditions. If such electric railways operate within limits where there is valuable underground property which may be endangered by electrolysis, the track voltage limitations, the potential wires for measuring these voltages, and the periodic tests of these voltages, as required in Clauses numbers 6, 7 and 8 hereof, shall be complied with within the limits affected.

(12) That the Winnipeg Electric Railway Company shall prosecute the herein specified work and equipment to com-

Note.—Clauses Numbers 1, 2, 3 and 4 of the foregoing are to apply to the railway lines of the company, as far as these lines are supplied with direct current from the sub-stations located within or near the limits of Winnipeg. Clauses Numbers 5, 6 and 7, however, are not made to apply to the lines extending beyond the limits of Winnipeg and St. Boniface, because these lines are generally located on country roads where the tracks can be substantially insulated from ground, and where there are at present no underground structures which could be affected by electrolysis.

pletion by midnight of the 31st day of October, A.D. 1916. That immediate action shall be taken by the company to prosecute the work and that monthly progress reports be delivered by the company to this Commission. The work accomplished from month to month, after this order goes into effect, must be such as to show that all diligence is being wrought to execute this order. In the event of want of diligence from month to month, as aforesaid, by the company in carrying out the work hereby ordered the City may apply to this Commission for the imposition of penalty for delay or for such other order as may appear proper. The company shall, in the construction, maintenance and operation of its electric railway system, continuously observe and perform all the directions contained in this order.

(13) That in the design and construction of the insulated return feeder system as required under this order, the Winnipeg Electric Railway Company shall employ a safety factor of 1.5, that is to say in determining the amount of copper required in the return feeders to reduce the voltage drop to the limit prescribed under Clause 5, which will be estimated theoretically under the normal peak load conditions, such amount shall be increased by fifty per cent. of itself to insure the fulfilment of the requirements under varying operating conditions.

(14) That in the installation of insulated return feeders and potential wires along Portage Avenue from Victoria Street to the St. James sub-station, and on Main Street from Graham Avenue to Sutherland Avenue, all wires and cables shall be placed underground in conduits of the company laid in streets as either already existing, or (as to Main Street) to be constructed according to the plans heretofore approved for that purpose by the Council of the said City of Winnipeg.

(15) In the event of the herein specified work and equipment not being completed by midnight of October 31, 1916, the Winnipeg Electric Railway Company shall pay a penalty of Fifty Dollars ($50.00) for each and every day that the default continues after the specified time.

Battery Exchange System Applied to Electric Passenger Vehicles—A Reasonable Solution

By A. Jackson Marshall*

There are a number of battery rental and exchange systems now available for electric commercial vehicles and it is interesting to note that recently a large manufacturer of passenger electrics in Chicago (Walker Vehicle Co.) announced very great price reductions, the vehicles now being put out without batteries, enabling purchasers to use the battery exchange and rental systems. However, it is stated that the purchaser of this particular make of car has the option of buying it with or without batteries. To those who desire to buy without batteries a large deduction is made. They can procure rental batteries from a local battery company or through an electric garage.

The customer has the privilege of laying the car off for two months during the year's contract for which time there is no charge for the battery after the customer has given the specified number of days notice. The capacity of the battery in ampere hours is guaranteed to keep up at all times when fully charged in such a shape as to deliver eighty per cent. of its rated capacity. The Battery Rental Company will make repairs of all broken jars, terminals or such minor repairs as are necessary from time to time to keep the battery in good operating condition. In other words, the amount paid per month to the battery company will cover all expenses and will provide the customer with a battery in prime condition at all times. Whenever the battery, through use, fails to give the required mileage, a new battery is put in. The customer agrees to accept the responsibility for the loss of the battery in case of fire, theft or collision. The Battery Rental Company agrees also that a deduction may be made from the rental if the battery is out of commission for more than 24 hours after notification by the owners of the car that it is in need of attention. The customer agrees to have the battery charged regularly and to give it reasonable care as to flushing and charging. The Rental Battery Company has the right to inspect the battery at the customer's garage at a reasonable time and further, has a right to remove the battery from the car without notice at any time upon failure of the customer to pay the regular rent.

It is claimed by the manufacturer that there are many excellent arguments in favor of this rental battery proposition. In the first place the exact maintenance costs on batteries will be known definitely to the customer. They will be no higher than the stipulated amount he pays per month for the full service. The customer, under this system, saves the cost of a battery which is sufficient to pay for nearly two years rental service. In addition to this the customer who employs battery rental service has no extras for the washing of batteries and renewals. It is argued that it is by far the more economical method.

Other considerations regardless of difference in cost must not be forgotten. After a battery has covered ¾ or 4/5 of its total life, and would still be able to give considerable service, it sometimes happens that its mileage capacity has materially decreased and that before the full life ot the battery has been consumed, it is necessary to purchase a renewal in order to get the required mileage. It is further maintained that with a rental battery, capacity is guaranteed and when it has reached a point that sufficient mileage is put in, a new battery is installed thus assuring the user of a rental battery of continued high efficiency at all time. Most owners of electric cars spend from one to two months out of town per year, at which time their car is taken out of service. In the case of a rental battery, during this time, a deduction is made and for the time this car is out of use their battery cost stops.

The vehicle manufacturer responsible for this particular system further states that the customer is also assured against any mishap in regard to treatment and care of his battery, the Rental Battery Company being responsible for keeping the battery in prime condition. When the customer owns his battery and through mistreatment or inattention, its life is impaired or depreciation sets in, he alone is responsible. It is pointed out that the general introduction of battery rental systems will very greatly change the complexion of the entire automobile industry, with greatly increased popularity for the electric.

*Secretary Electric Vehicle Association of America.

New Books

The Electric Railway—by A. Morris Buck, M.E.; McGraw-Hill Publishing Company, New York, publishers; price $3.00 net. This volume has been prepared as a textbook for the instruction of advanced students taking electric railway courses. It will also be found of interest to the practising engineer, since it purposes to give the underlying principles of railway design and operation. The scope of the work is fairly described under the following chapter headings:—The Mechanics of Traction; Motors for Traction; Railway Motor Construction; Control of Railway Motors; Power Requirements and Energy Consumption; Braking of Electric Railway Trains; Cars and Car Equipment; Electric Locomotives; Self-Propelled Cars; Electric Railway Track; The Distributing Circuit; Sub-stations for Electric Railways; The Transmission Circuit; Power Generation; Signals for Electric Roads; Systems for Electric Railway Operation; Engineering Preliminaries.

The Dealer and Contractor

Trial installations of bare concentric wire for interior work—Boston Edison Company are making experiments on three houses—Results so far satisfactory—Cheaper and easier to instal

By special permission of the Boston Board of Fire Underwriters and the Boston Commissioner of Wires, three houses in Boston were equipped during the past summer with bare concentric wiring, these being the first installations of the kind in America. The insurance and city authorities authorized these installations as an experimental demonstration of the applicability of bare concentric wire to interior-wiring conditions. Early in the spring about a mile of bare concentric wire was manufactured by the General Electric Company on an order from the Boston Edison company for experimental use, and the first installations were carried out by Herbert S. Potter, a Boston electrical contractor. The Electrical World describes in some detail the wiring arrangements in these three houses as follows,—

The first of the three houses thus wired is in Dorchester and, like the other houses, contains about 500 ft. of No. 14 B. & S. gauge bare concentric wire. There are twenty-five outlets, which supply six 15-watt, five 25-watt and ten 40-watt lamps. Two of the rooms in this residence were wired with concealed conduit in the usual manner, all other portions of the house being equipped with bare concentric wire. The leads to the meter are brought into the house by overhead service carried in pipe to a condulet from which the leads are run open to the cut-out box and meter, one side of the circuit being grounded to the entering pipe with a standard ground clamp. A No. 6 tap runs from the grounded leg across the cellar to a water-pipe connection. Beyond the meter taps are taken at a fuse block to feed the two rooms wired in conduit, the leads being continued to a point near the upper left-hand corner of the board, where one side is dropped to form a short horizontal bus from which three taps are taken through inclosed fuses of 10-amp. rating. Each fuse controls one bare concentric circuit, the sheath of the wire being connected to the upper lead from the meter, while the fuses are connected to the inside conductor of the concentric run in each instance. The connection between the sheath and the meter lead is made by "twist-ons" of the European type, one end of the twist-on being soldered to the meter lead and the other merely clamped around the sheath. The meter board measures 3 ft. 8 in. by 2 ft. 6 in. in length and width, being of 0.875-in. plank. In the extreme upper left-hand corner of the board a ground connection is made between the sheaths and the No. 6 lead running to the water pipe. The three bare concentric wires leading from the meter board feed several lamp circuits in the house through appropriate junction boxes.

In the sewing-room of the Dorchester house two outlets were provided, one for a 60-watt bracket lamp mounted on the wall about 6 ft. above the floor, and the other for a baseboard receptacle available for sewing-machine motor or other service. The wire is about 3/16 in. in diameter and is attached to the wall on the surface of the papering by 1.25-in. by 0.375-in. metal clips screwed into the laths. In the future outlets will, as a general rule of practice, be fed from above, thus avoiding as far as possible bringing the concentric wire so close to the floor that it is likely to be struck by chairs, brooms or vacuum-cleaner handles, etc., when moving furniture and other domestic equipment about.

In the first house wired the bracket lamps were mounted on circular wooden blocks about 0.875 in. thick, at the request of the insurance interests, but in the later work the canopy surmounts a small metal plate of "Renim" make, which provides ample clearance. This plate is 3.5 in. in diameter and had to be slotted at the top with a hack saw in order to admit the concentric wire. It is screwed into the wall at three points and affords a convenient canopy base prior to the development of a standard base for this type of service.

In the first Dorchester house a gang of three-way switches is installed in a wall plate in the front hall. One switch controls a porch lamp, another a lamp in the front hall, and the third governs a lamp in the hall on the second floor. The switches are of the three-way type for interior lamp control, and the main feed is brought up from the cellar and runs along the baseboard of the hall until it reaches a point immediately under the plate, when it rises to the latter, passing under the wooden base to the terminal points. Five concentric leads leave the switch plate at the top for the various services above enumerated. Although these leads are run exposed on the face of an attractive wall paper, the tinned sheath of the wire is rendered less conspicuous than at first might seem to be the case by a coat of brown-paint.

The porch lamp in this house is supplied by a concentric-wire circuit run from the door frame across the ceiling to the lamp base. Here again, by painting the wire to accord with the piazza ceiling and to match the shingles, the feed is rendered inconspicuous, being much smaller than a gas pipe and only a trifle larger than the capillary tubing used in acetylene distributing systems.

The second house wired, also in Dorchester, is provided with bare concentric equipment throughout. It has seventeen outlets, supplying lamps ranging from 15 watts to 60 watts in size, and is fed by 3-in. iron conduit run from an adjacent manhole to a 3-ft. 5-in. by 2-ft. 6-in. service board in the cellar. Beyond the meter the leads are separated, one being connected bus-fashion to the terminals of three fuse plugs, while the other lead is carried upward and connected to the sheaths of the bare concentric distribution circuits. The ground connection is made from the sheath to the water pipe as before, and "twist-ons" are used. There are three main circuits in the house, bunched with common clips and running along the ceiling of the cellar to distributing points from which the upstairs services are taken. In the case of the cellar drop lamp the bare concentric wire is run from a junction box on the ceiling to a standard rosette, the connections at the latter being made by the inside conductor

and by the short lead run from the sheath. Each circuit is fused at 10 amp. A 5-amp. meter in installed and the fuses are mounted on a common 3-in. by 4-in. block. One circuit runs directly to an electric flatiron receptacle in the kitchen. It is carried up from the cellar and run upward along the wall inside a mechanical protecting sheath of brass until it reaches the level of the paneling top, whence it is run open and bare horizontally to a porcelain block carrying the fuses, pilot lamp, switch and receptacle.

In the wiring of the dining-room in the second house the feed is brought up through the cellar, with a protecting sheath which it is hoped in the future can be eliminated by running the lead behind the baseboard, and is carried along the door frame to a snap switch. Thence it rises to the height of the picture molding, runs parallel to the latter along the face of dark-colored wall-paper, and crosses the ceiling in a short run leading to the fixture canopy. Mechanical protection at the edge of the canopy is provided by a short fibre tube surrounding the concentric wire sheath. Lamps of 15-watt, 40-watt and 60-watt rating are installed, ordinary rubber-covered wire being run from the canopy to the lamp-bases. The lamps are hung about 4 ft. above the table. In this house one circuit feeds the flatiron, another the first floor, and a third the second floor.

The third house of the trio wired is at Jamaica Plain. The feed is by overhead service through pipe and condulet to a meter board in the basement just below the front hall. The general arrangement of connections is as previously described. Three bare concentric circuits are used, with a 6-amp. fuse in one lead of each, "twist-on" connections, and ground wire to water pipe. One flatiron and two lighting circuits are provided. The junction boxes are of the usual recessed type, inverted and slotted to receive the concentric conductors. There are eighteen outlets in the house.

Diagonal pliers, ordinary pliers and a knife were the principal tools used in the installation of these wiring jobs, with a home-made bending block 5 in. long, 1.5 in. wide, and provided with a 5/16-in. slot 0.125 in. deep. The minimum radius of bending was about 2 in., the sheath having a tendency to crack below this. In view of the experimental nature of the work, no cost figures are available, but it was found that the cost decreased rapidly between the first and third jobs, the last being about on a par with the cost of wiring according to the present Boston Edison house campaign.

With improved fittings and experience, the field of this kind of wiring is thought to be assured. The occupants of the residences so wired are satisfied with the service, and the wiremen who put in the installations were enthusiastic in praise of the concentric conductors.

Wiring Houses on the "Campaign" Plan

As between wiring a house badly—that is inadequately—and not wiring it at all, electrical contractors cannot, of course, very well hesitate. While we all know that much of the work that is being done from day to day is not sufficiently complete to meet the needs of the case in hand it is no doubt better that this should be so than that a large number of houses should be left without electrical supply of any kind whatever. It is this that reconciles us to the so-called "campaigns" which undertake to wire any house of a certain size throughout a given district for so much—the smallness of the payment being generally a bigger attraction than the convenience or profit that will result from the installation.

These campaign installations, however, inasmuch as they are rarely of much credit either to the individual who instals them or to the electrical profession in general, are usually only put in in districts that have been thoroughly worked over beforehand for a better class of trade. It is a case of this or nothing. Central stations in general are responsible in that they have taken very kindly to this type of installation, since it means an immediate, and often not inconsiderable, increase in revenue to them from the further sale of current. The central station has not, of course, the same interest or pride in the excellence of the work in any certain installation that the electrical contractor has.

It is generally argued too that an installation of wiring in a house, however incomplete it may be, usually represents the thin edge of the wedge which may be driven home gradually as the value of electric lighting and appliances becomes more evident to the consumer. So there has developed throughout the continent this habit of carrying on campaigns for wiring, generally including the installation of lighting fixtures, for a minimum, and often incredibly small, sum. Usually this work is done through an understanding with a number of contractors in the town or city in question and, everything considered, it probably means that conditions are improved within that certain area as rapidly as they could be by any other type of campaign.

One of the latest records we have seen is that of the Cumberland Power and Light Company of Portland, Maine, described in the current issue of the Electrical Review. This company began a systematic campaign for the wiring of houses and other buildings on September 20 and offered the following four alternative propositions to the Portland householders:—

(1) Exposed wiring, 6 drop cords, porcelain shades, \$17. Terms, \$2 with order, \$2 a month.

(2) Concealed wiring, 7 fixtures, \$42. Terms, \$3.50 with order, \$3.50 a month.

(3) Concealed wiring, 7 fixtures, \$48. Terms, \$4 with order, \$4 a month.

(4) Concealed wiring, 7 fixtures, \$58. Terms, \$4.83 with order, \$4.83 a month.

Fixtures with proposition No. 2 include a pendent hall fixture with bell shade, three-light dining-room pendent chain chandelier, chamber and bath wall-bracket, three-lamp living-room shower, drop tube kitchen light with shade, and porch globe with wall switch. Propositions 3 and 4 call for more expensive glassware, the fixtures being of the same general types. An additional light, with either drop tube or wall bracket may be added for \$4. A flush wall switch is installed for \$4, and a cellar light and switch for \$4.

All work is divided among ten local contractors who have already agreed upon unit prices after having gone over the matter among themselves. The central station gives each householder accepting the offer a handsome portable table lamp gratis.

Solicitation of the business is done by the lighting company's three salesmen, besides a power agent who devotes part of his time to the work. A canvas is first made of all houses not wired, and "lead memos." are filled in by the salesmen as the result of each call. These blanks provide for the householder's name, business, address, etc., and have spaces below for entry of dates of calls, with final blank space to be filled in when the contract is closed.

These memoranda are turned in to the business office daily. Here they are assorted, and the memos. which indi-

cate that the prospect was absent from home, not yet ready to talk business, or willing to consider the proposition on a certain day, are placed in pigeon holes labelled with the days of the succeeding week and month. Each day's work on prospects already solicited and partly convinced of the desirability of an installation, is thus cut out for the salesmen, who take the memos. for the day and call again, as arranged at the previous interview.

In the office is a blackboard 5.5 feet long and 3 feet high, lined off in red, with vertical columns for residences, apartments, other buildings, total and total kilowatts. Horizontal lines provide for the entry of daily, weekly and monthly contracts secured, with their kilowatt capacity, and footings under each of the time periods.

Another blackboard is for the entry of contracts gained for commercial business and appliances. This board is 12 feet long and 6 feet high, ruled in red, with divisions for four salesmen, and each division provides spaces for sign lighting, front lighting and office sales, showing number of each type of unit sold or contracted for, with their connected load and totals.

This board is ruled by days, weeks and months for the year and the figures show at a glance just the amount of business that has been secured the last full week and month, and for the year.

A third device for indicating graphically the progress of business, is a clock face about 3 feet in diameter with dial marked off in spaces of 10 kilowatts each. One hand indicates the total motor load in horsepower at the present date, and the other hand the load one year ago on the same date.

A campaign of nine months recently conducted by the company resulted in securing 715 new contracts, and only three salesmen were employed.

The company's net lighting rate is 8.5 cents a kilowatt-hour, with a minimum charge of $12 a year.

Segregate the Electrical Contract

The electrical contractors in the state of Massachusetts recently met in convention at Springfield. In the last issue of the Electrical News we printed, practically in its complete form, the new license law just enacted by this state, which requires both the master electrician and the journeyman to take out a certificate. One of the important resolutions passed at this convention had reference to the definition of the word "journeyman." Another important motion, a copy of which will be forwarded to the State Board of Examiners, was submitted by the committee on segregation. The entire separation of the electrical contract from the other trades, which the electrical contractor has so long contended for, is now finding favor with builders and architects, especially the latter. It is also receiving considerable attention at the present time from the National Association of Electrical Contractors. The motion of the Massachusetts committee is thus of special interest and we reproduce it in full.

"Mr. President and Gentlemen: Your committee appointed to draw up a resolution relating to the segregation of electrical contracts from general contracts, begs leave to present for your consideration the following:

Resolved, That the Electrical Contractors' Association of Massachusetts, in convention assembled, do hereby endorse as being for the best interests of the electrical contracting business the resolution adopted by the American Institute of Architects relating to the segregation of electrical contracts from the general contracts, which is as follows:

Resolved, That the American Institute of Architects, in convention assembled, recommends to the members of our profession the adoption of the practice of direct letting of contracts for mechanical equipments, such as heating, plumbing and electrical equipment. This recommendation is based on the conviction that direct letting of contracts as compared with sub-letting through general contractors affords the architect more certain selection of competent contractors and efficient control of work, and at the same time serves more equitably the financial interests of both owner and contractor.

It is further suggested that in sending notice of the above action to architects, engineers, boards of public works, etc., and other interested parties, that the following letter would not be inappropriate:

The Electrical Contractors' Association of Massachusetts present for your consideration the following reasons which make it desirable to separate the electrical work from the general contract:

First, the details of this work (such as locations, etc.), should be taken up direct with the architect or owner and not have to go through a third party, who has no special interest in the work aside from having it done at a low price.

Second, the general contractor adds a percentage to the electrical bid and it is our feeling that the interests of the owner would be better served if this additional amount was used to secure more or better work.

Third, the general contractor is usually obliged to award the contract for the electrical work to the lowest bidder, as he receives his contract because his bid was the lowest, and the general contractor has no interest in the electrical work other than to have it pass the inspection. This inspection has to deal with the fire hazard only and does not take into consideration the loss in wires, the provisions for additional service, and many other things essential to the interest of the owner.

Fourth, the estimate on the electrical portion of the specifications is usually secured in a hurry by the general contractor, with result that the estimate is inaccurate and low. Later, when the general contractor attempts to award the electrical work, he finds that the bids were above his allowance, and he consequently feels obliged to give the work to the lowest bidder.

This results many times in the order being given to an inexperienced concern of poor financial standing, and, furthermore, it frequently happens that soon after a piece of work is finished the electrical contractor who did the work goes out of business and any troubles developing have to be taken care of by the owner, which would not be the case if the work had been done by a responsible electrical contractor.

Valuable Report on Contract Legislation*

Last year this committee presented a complete report of its work in book form, covering 96 pages, and containing a reprint of all existing laws and ordinances of which your committee had knowledge. This represented a considerable item of expense for both collecting and printing, which your committee does not feel it can incur this year. While some important laws and ordinances were passed in various parts of the country during the past year, and undoubtedly would be of considerable value to our membership if reprinted as part of this report, yet your committee did not think it advisable to incur the extra expense of printing them as part of its report. However, attention will be called to new legislation of the past year, and the committee will endeavor to furnish copies of these laws and ordinances to all members who may be interested in same.

During the year two States succeeded in passing laws segregating electrical work from the general contract on public work; namely, Illinois and New Jersey. Laws of this character are also in force in the States of New York and Pennsylvania. These laws, in general provide that **on all public buildings separate plans and specifications are to be prepared, and separate bids to be tendered** for electrical and kindred work on these buildings. This surely is a step in the right direction, and will undoubtedly do much to improve the status of the electrical contractor. Such legislation tends to overcome certain abuses and dangers to the trade which are admitted to exist. If these laws were in force in every State of the Union, and if, further, they might apply to private as well as public work, the electrical contractor and the public would feel that ideal conditions had been attained.

Still this is not an idle dream; it is possible of attainment if all the electrical contractors would work toward that end and determine to bring these conditions into being. As a matter of fact, the work has already begun to bring about these conditions, and it behooves us, for our own good and welfare, to render every assistance possible to make it an accomplished fact. The committee refers to a resolution passed at the last convention of the American Institute of Architects at New Orleans, to the effect that the institute **recommended to its members to segregate plumbing, heating and electrical work from the general contract, and award them separately** to their respective contractors. This resolution was concurred in by the National Electrical Contractors' Association at the Detroit Convention in 1914.

Electrical work should be let direct to the Electrical Contractor; there is no need of a middle man, who knows little or nothing about the work, and who at best makes the Electrical Contractor finance the job and takes the profit which belongs to the Electrical Contractor.

If these conditions are brought about another abuse will disappear, namely, the peddling of bids on the part of the general contractor. This practice, which is general throughout the country, is against the best interests of the owner as well as the electrical contractor. Under this system the quality of the electrical work must necessarily suffer, which brings discredit to the responsible electrical contractor, and to the electrical business in general. This system has also a great bearing on the electrical contractors' credit, inasmuch as he is at the mercy of the general contractor in the matter of payments for work done, which payments so often are long delayed, tying up the capital of the electrical contractor and affecting his credit as a result.

Segregation laws and creating conditions whereby separate electrical contracts are let on private work are, therefore, well worth working for and are hereby recommended to our membership. During the year the State of Massachusetts passed a license law covering both master and journeyman electricians. It provides for an examination and fee of \$25.00 for master electrician, and an examination and fee of \$1.00 for journeyman, with a penalty of a fine, imprisonment or revocation of the license for cause; no bond is required, the penalty is deemed sufficient guarantee to safeguard the public. New city ordinances have been enacted as follows: Portland, Oregon, has a license law requiring a license fee of \$25.00 without an examination, and all journeymen must be registered. It permits property owners to do their own electrical work without a license. Inspection fees are charged. Kansas City, Kansas, recently passed a license law providing for an examination. Richmond, Virginia, has a law requiring an examination, a fee of \$25.00 and bond of \$1,000.00. Topeka, Kansas, requires an examination, a fee of \$1.00 and bond of \$1,000.00 St. Louis, Missouri, recently enacted an ordinance requiring a license fee of \$10.00 yearly and bond of \$1,000.00. New York City just passed an ordinance requiring a license fee of \$10.00 the first year and \$5.00 each subsequent year; it also provides for an examination by a license board of seven members. In the city of Medford, Oregon, the new ordinance requires an examination, a yearly fee of \$25.00 and a bond of \$200.000. The cities of Albany, New York; Evansville, Indiana, and Los Angeles, California, have recently enacted license ordinances governing electrical work.

Laws providing for the licensing of the electrical contractor are perhaps more important than those segregating the electrical work from the general contract, although the two should go hand in hand. The business of doing electrical work in accordance with modern standards of safety requires years of training, study and application. The doing of electrical work by the inexperienced and unscrupulous contractor, whose only aim is profit, jeopardizes public safety or stability of the work, his interests in profits are paramount, and all other considerations are sacrificed to this end.

Thus there is an opportunity to legislate to the mutual advantage of the public to protect them against irresponsible contractors, and of the contractor to protect him against unfair competition and establish his responsibility for installations.

License laws should be framed to identify the responsible party as well as specify how and by whom electric work should be done. **It should be a misdemeanor to do irresponsible work, with a suitable penalty of a fine, imprisonment or the revocation of the license for cause.**

License laws which are carefully drawn and enacted, and wisely administered, will dignify the business and do more to improve the status of the electrical contractor than anything else.

Your committee would strongly urge the membership to consider carefully the advantages a suitable license law would give them in their respective States and cities, and to use every effort to have protective and corrective legislation enacted if none exists.

It would appear that it is just as essential to see that a law is enforced as to have it enacted to derive benefit therefrom, and it, therefore, behooves the electrical contractor to see that this is done. You owe it to yourself and your business to see that laws affecting your business are either strictly enforced or repealed. A law that is dead because of lack of enforcement had better be repealed. Some local-

*Presented before the National Electrical Contractors' Association at the Annual Convention at San Francisco, by Paul H. Jaehnig, Chairman.

ities report such laws and consequently conditions are not satisfactory. From other sources the committee have reports that the license fee is too low and no examination is required.

Your committee believes that one of the fundamental provisions of a license law is a thorough examination to determine the qualifications and responsibility of the applicant. A license law that does not provide for an examination is very unsatisfactory to the legitimate electrical contractor, as this permits anyone who can pay the required fee to engage in electrical work, irrespective of their fitness or responsibility. Such laws afford no protection whatever to the legitimate electrical contractor, and tends rather to degrade than elevate the standard of electrical work. See that your license law has a satisfactory examination clause. The amount of the license fee is immaterial, as this affords little or no protection against the irresponsible electrical contractor, in fact a nominal fee is all that is required. Your protection lies in having an examination fairly conducted by competent examiners to determine the qualifications and competency of the applicant to conduct the electrical business. A license law should establish the responsibility of the electrical contractor for his work, making it a misdemeanor to do irresponsible work, rather than requiring a bond. A law that penalizes by fine, imprisonment or both and a revocation of the license for cause will do more toward assuring safety and stability of electric work than the fear of a suit under a bond. Furthermore, it makes the penalty, which is swifter and surer, fit the crime, and gives the public better protection than under a bond. Many of these points were touched upon in last year's report, and the experience of the past year has emphasized some of them, showing the necessity of framing your laws carefully in order to secure mutual benefits and protection.

In reference to a model State law and city ordinance, your committee feels that up to the present time they have not sufficient data and information on the subject to attempt to offer anything along this line. This phase of the committee's work requires not only time and thought, but the co-operation of every member of our association in localities where legislation is in force. It requires the actual experiences of the members working under existing laws to determine which provisions of them are beneficial to the public and the electrical contractor, and which are otherwise. It requires a process of elimination and refinement to attain model legislation and only by such means can the electrical contractor hope to reach the desired goal. It requires time, thought and energy, which the average electrical contractor is unwilling to sacrifice for the good of the trade.

Referring again to the Massachusetts State license law, above mentioned, this law differs from others in the fact that it provides for the licensing of both the master electrician and the journeyman. It requires an examination before a board of examiners to determine the fitness of the applicants and requires a fee for the licenses, with a yearly renewal fee. It prohibits a master from doing practical electrical work; he is permitted to conduct the business of an electrical contractor, and the journeyman is exclusively given the right to do the actual work. Whether this is a wise provision of this law, your committee is not in a position to state, as it requires experience to determine whether it will directly benefit the electrical contractor and public. It would seem that a monopoly has been created for the journeyman, which restricts, in a measure, the freedom of the master in employing labor. Furthermore, this provision of the law places the journeyman in a peculiar relation to the master. The operation of this law will be watched with interest by the electrical contractors throughout the country; first, because it is the most recent State law enacted, and, secondly, because of its stated provisions.

Laws for Licensing Electrical Contractors

Licensing laws are multiplying rapidly in the United States and their experience may well be used to our own advantage. After several years they have doubtless eliminated many of the errors we, at the beginning, would naturally fall into. The most recent ordinance of the city of Topeka is just to hand. Apparently no fee is charged for license though an examination is required and a considerable bond. The section referring to this matter reads as follows:—

"The Electrical Inspector shall issue no construction permit for proposed work and shall issue no certificate of inspection, as hereinafter provided, to any person, firm or corporation for electrical construction work, until he or they shall first produce a license from the City Clerk allowing him or them to do such electrical work. The City Clerk shall issue no license until the applicant therefor shall have filed a bond in favor of the city of Topeka executed by some surety company authorized to do business in the State of Kansas in the sum of one thousand dollars ($1,000) conditioned that the principal in said bond will install electric light, heat and power wires, fixtures, appliances, conductors, apparatus and their supports as required by the ordinances of the city of Topeka, governing electrical construction work in said city; and it is hereby made the duty of the City Clerk to issue such license to the person, firm or corporation filing such bond; provided, however, that persons, firms and corporations engaged in other business, but doing their own electrical construction work, shall not be required to file such bond, unless such person, firm or corporation shall do electrical construction work for other parties, in which case they shall be required to file said bond."

The Examining Board consists of three members, as indicated in Section 4 of the city ordinance.

Sec. 4. "That there is hereby created a Board of Examiners to pass upon the qualifications of all persons doing electrical wiring or electrical work in the city of Topeka, Kansas. Said board shall consist of three members, one of which shall be the Electrical Inspector of said city, who shall be ex-officio chairman of said Board of Examiners. The second member of said Board of Examiners shall be a master electrician and the third member thereof shall be a journeyman electrician. The second and third members shall be appointed by the Board of Commissioners of said city and shall hold their office for two years and until their successors are appointed and qualified. Each of the members of said Board, except the Electrical Inspector, shall be paid the sum of 50 cents for each examination as hereinafter provided."

According to Section 6 the Board may cancel or revoke any certificate of examination if the holder is found guilty of violating any of the terms of the ordinance,—this evidently is the most effective form of penalty.

Sec. 6. "Every person, whether an employer or employee except a helper, before engaging in electrical wiring and electrical work in the city of Topeka, shall apply to said Board and pass an examination as to his competency as an electrician and, if on examination such applicant is found competent to do electrical wiring and electrical work, said

Board of Examiners shall issue a certificate of examination to such applicant, authorizing him to engage in electrical wiring and electrical work in said city. The fee for the examination of each applicant shall be one dollar, said fee to be paid to the City Treasurer of said city at the time the applicant applies for such examination and shall be retained by said city whether the applicant passes the examination or not. Such certificate of examination shall continue in force until revoked or cancelled by said Board of Examiners; but such certificate shall not be transferable. Said Board of Examiners shall have power and is directed to suspend for a definite time or to cancel or revoke at the discretion of the Board any certificate of examination granted thereunder, if after notice and opportunity to be heard the person holding such certificate is found guilty by said Board of violating the terms and conditions of the ordinances of the city of Topeka, governing electrical construction work or the rules and regulations established by said city under the charter or ordinances."

An excellent proviso also makes it unlawful for any person except a licensed electrician to make even the smallest change in the electric wiring. If capable of enforcement this regulation will do away with the "smart boy" type of danger which is very real in many homes. This ordinance reads:—

"It shall be unlawful for any person or persons in the city of Topeka to place or install any electric light, heat or power wires, fixtures, appliances, conductors, apparatus or their supports in, or upon, or in connection with any building, shop, outhouse, shed or other structure within the city of Topeka, without first having passed the Examination before the said Board as hereinbefore provided, and obtained from said Board a certificate of examination as hereinbefore set forth; provided, that any persons holding a certificate of examination as aforesaid, may employ one helper to assist him in any work as aforesaid, which helper shall not be required to pass said examination, but such helper shall work in the presence and under the immediate supervision of the party holding such certificate of examination."

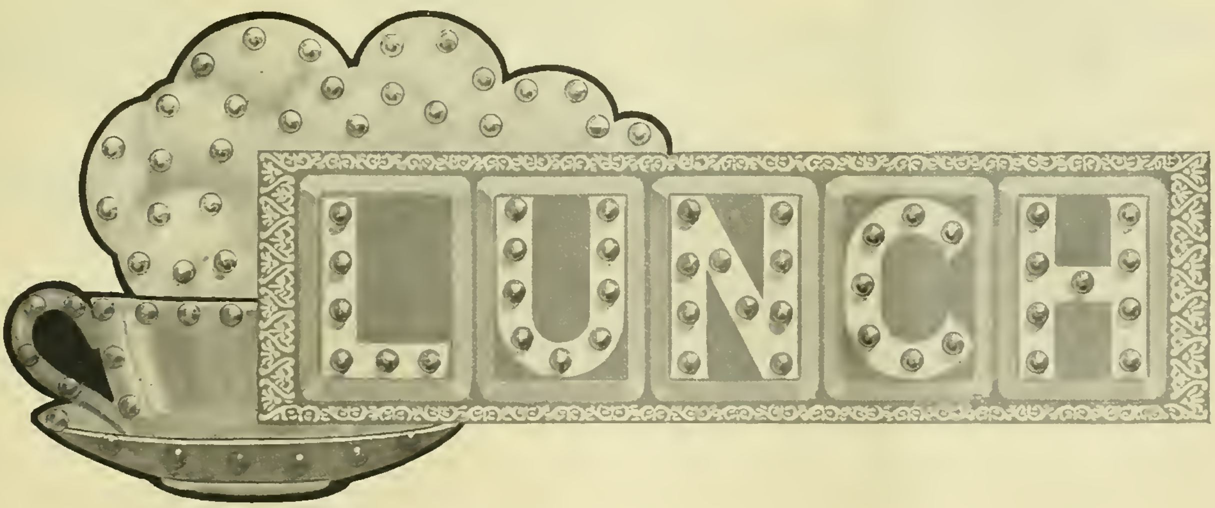
Two Miles Falls Development

A hydro-electric development on the St. Francis River, at Weedon, P. Q., is nearly completed. It is owned by the Two Miles Falls Water Power Company, and will supply current to the copper and asbestos mines in the vicinity. The present installation is for 1,250 h.p., but plans are made for an ultimate production of 3,250 h.p. The power house is of concrete, the water wheels being set in an open flume of reinforced concrete. The head is 30 feet. The turbines are of the direct connected horizontal type, supplied by the William Hamilton Company, Limited, Peterborough, and the generator is 750 kv.a. 3 phase, 60 cycle 200 r.p.m. manufactured by the Canadian General Electric Company. The panel board is equipped with Wagner instruments. The power will be stepped up to 15,000 v., and, when the entire plan is carried out, to 27,000 v. The transmission line, of wooden poles, will be connected with the transmission system of the St. Francis Water and Power at Disraeli, and will be extended as occasion requires. The new storage dam to be built by the Quebec Streams Commission will allow of the storage of almost three times the present water storage on Lake St. Francis, and will materially improve the reliability of the supply on the St. Francis River. The dam will of course be of immense benefit to the Two Miles Falls Water Company. Mr. M. A. Sammett and Messrs. Surveyer and Frigon, Montreal, were the consulting engineers.

Hamilton Section C. E. A. Annual Meeting

The Annual Meeting, and first meeting for the season, of the Hamilton Section of the Canadian Electrical Association, in affiliation with the National Electric Light Association, was held on Tuesday, October 5th, in the splendidly equipped Section meeting-room, Terminal Station, Hamilton, which has been placed at the disposal of the Association by the Hamilton Cataract Power, Light and Traction Company. The chair was occupied by the retiring President, Mr. W. A. Sweet. The attendance was good, about 50 members being present. The annual election of officers resulted in the following being elected:—honorary president, Wm. C. Hawkins; honorary first vice-president, E. P. Coleman; honorary second vice-president, W. G. Angus; president, L. W. Pratt; vice-president, Chas. H. Fry; secretary-treasurer, Leo V. Blatz; executive committee, Geo. E. Waller, Walter Kelly, Chas. H. Hutton and Geo. H. Goring.

The feature of the evening was a most entertaining lecture by Mr. Fred. Mitchell of New Britain, Conn. This unusually educative lecture was profusely illustrated by lantern slides. Musical selections were rendered very acceptably by E. Nicholl of the Substation Department, and by Westcott & Company of the Brantford plant. After a hearty vote of thanks in recognition of the efficient work done by the retiring president, W. A. Sweet, the meeting closed with "God Save the King."

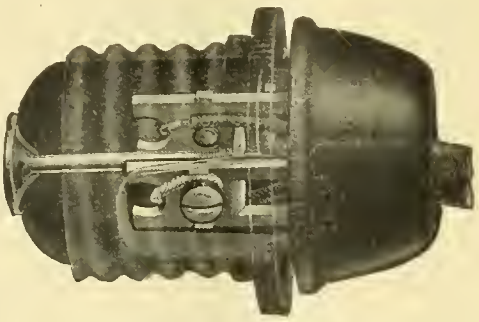


Attractive Electric Signs - Federal Sign System (Electric), Toronto.

What is New in Electrical Equipment

New Attachment Plug

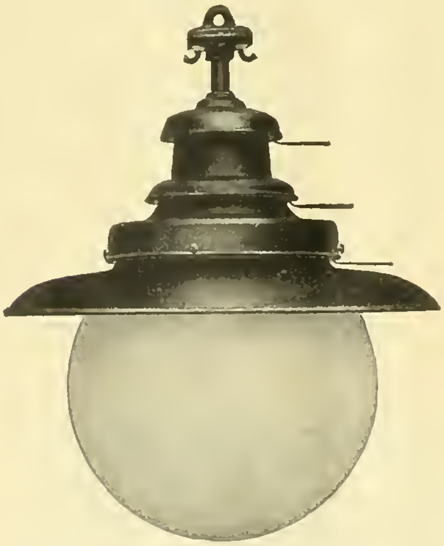
An attachment plug which, it is claimed, reduces the time of wiring to half of that required with other types of plugs, has been developed by the Best Electric Company, Pittsburgh, Pa. This plug is equipped with a new strain-relief device which the manufacturers claim takes the full stress of any pull or jerk on the wire, thus eliminating the necessity of a knot in the wire. In wiring, both wires are



cut even and there is no necessity for fishing in holes for the lead-in wires. Only one screw has to be removed in order to render the interior of the plug accessible for wiring. An asbestos compound which, it is declared, cannot crack or melt is the material used in the construction of the plug.

Ventilated Fixtures

The Herwig Art Shade & Lamp Company, Chicago, are marketing through the Canada Sales Company, 166 Bay St., a new line of ventilated fixtures especially designed for the Type "C" nitrogen filled lamps. As the illustration shows, these fixtures are amply ventilated at three places. They



are furnished with or without the reflectors, the latter being made in five sizes from 16 to 22 inches diameter. On account of the increasingly strict regulations as to fixtures for nitrogen filled lamps being properly ventilated, this design should meet with the approval of all contractors.

The Capital Electric Company, Limited, have been incorporated with head office at Ottawa and capital stock of $40,000.

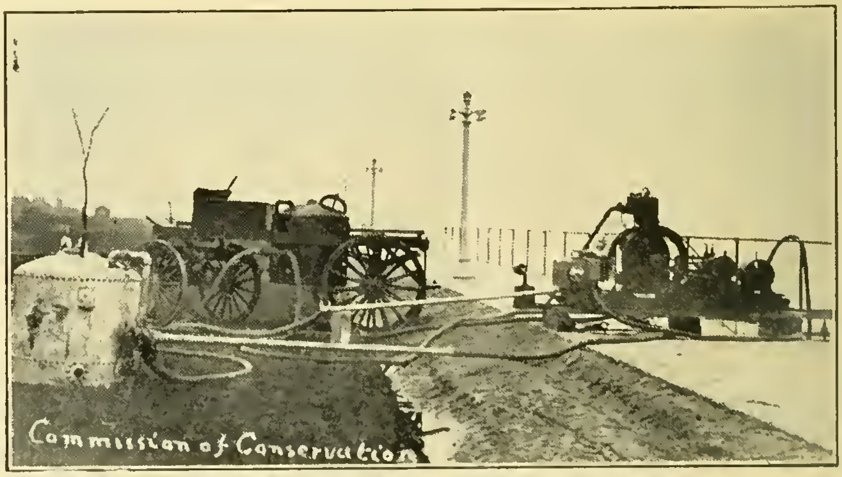
Jovians Elect New Officers

The Winnipeg Jovian League held their first luncheon on September 29th at the St. Regis Hotel, Winnipeg. The secretary-treasurer's report and financial statement was presented and the following officers were elected for the ensuing year: President, J. S. Madden, of the Canadian General Electric Company; vice-president, E. H. Smith, of the Westinghouse Company; secretary, W. E. Skinner; executive committee, W. G. Vogan, J. S. Henry, Albert Esling and H. Long.

Purifying Water with Ultra-violet Rays

Various means have been adopted by municipal health authorities to afford greater protection to their water supply and many filtration plants have been erected. In several cities, the final sterilizing agent used in treating water has been chlorine. This, however, has one objection—its varying character. When used to excess, as is often necessary, it gives the water a very disagreeable taste. Efforts have been made to overcome this, but with little result, especially in water supplies containing considerable organic matter.

Of late years the French and Austrian military authorities have been experimenting with a small, ultra-violet ray equipment with such success that, prior to the opening of the military camp this year at Niagara-on-the-Lake, Ontario, it was decided to test the system, upon a comprehensive scale. The Niagara River, the source of the town's water supply, is so seriously polluted, and such extensive quantities of bleaching powder were required to protect the camp, that the water was rendered unfit for drinking. The apparatus for the new process consists of two mechanical filters, an ultra-violet ray sterilizer and a small gasoline engine to generate the necessary electric current. Since its installation, 2,000 gallons of pure water (practically a sterile water, colon being absent in 50 c.c. quantities in 90 per cent. of the samples examined) per hour have been secured for the camp from the lower Niagara River, which, only two years ago, was reported by the International Joint Commission as unfit for human consumption.

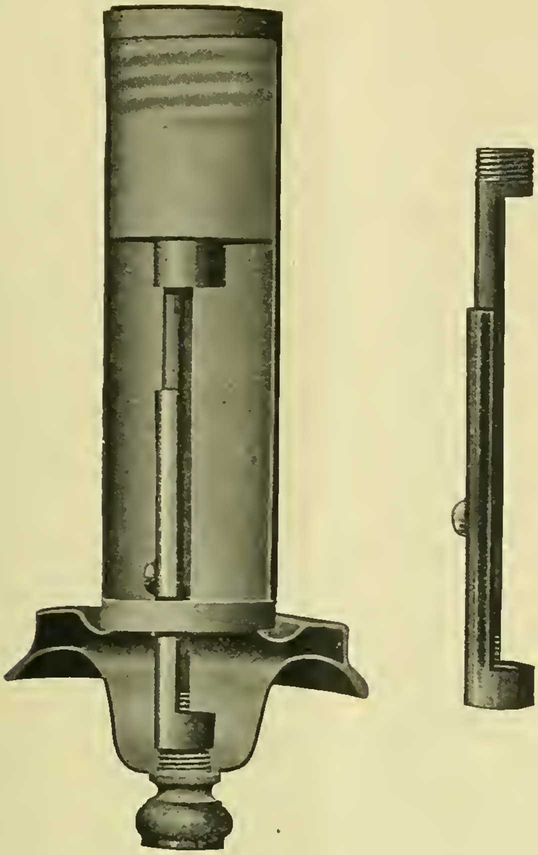


Ultra-violet Ray Water Purifying Equipment.

A large interchangeable electric display sign has been erected over the Nickel Range Hotel in Sudbury by the Denis Advertising Signs, Limited.

An Adjustable Candle Stem

The accompanying illustration shows an adjustable candle stem for use with standard size socket, manufactured by the Faries Manufacturing Company, Decatur, Ill. This adjustable stem can be used on any size or length of candle



for either fixture or bracket. It is made of heavy tubing, open to facilitate wiring. The adjustment is simple and quick and is claimed not to slip when the screw is set. Made in two sizes for regular socket and candelabra socket.

Electrically Heated Device for Keeping Automobile Wind Shields Clear

The accompanying illustration shows a device developed by the Fuller Electrical Appliance Company, Wellesley, Mass., for keeping the wind shields of an automobile clear on rainy and foggy days in sleety weather. The "Way-C," as it is called, consists of a metal frame which fits closely

to the wind shield and dries the space inside the frame by means of electricity, thereby permitting an unobstructed view of the road ahead. The frame contains a coil of insulated wire which rests against the glass and is connected to the automobile storage batteries, sufficient energy being supplied for heating the glass within the frame and keeping it free from all moisture. The device is equipped with two silver-alloy hooks and two steel springs for attaching it to the wind shield, and also with a cord and plug to connect it to the battery circuit. To place the device in position one hook is hung over the upper edge and the other hook is attached to the lower edge of the wind shield; a spring is inserted in each of the hooks, and the frame is fastened to these springs. The frame may be quickly attached or detached as needed, and can be adjusted to wind shields of different widths and elevations by shortening one of the springs.

Franklin Portable Lamps

The Franklin Duplex illustrated in Fig. 1 is a lamp suitable for desks or library tables where two or more persons may require to use it. It makes an ideal lamp for public library reading. The shades are adjustable to protect the eyes of the user and it has a substantial appearance that

Fig. 1.

will increase the attractiveness of any room. This shape is designed to light an area of approximately seven by four feet.

The type shown in Fig. 2 is for a roll top desk or piano; the general features are the same as in the unit shown in Fig. 1. This unit is adjustable up or down and swings hori-

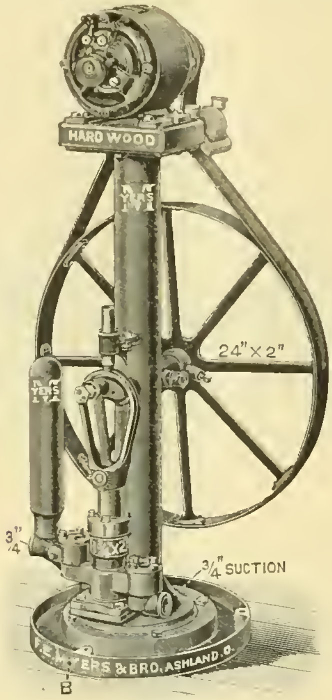
Fig. 2.

zontally; the shade also is adjustable so that it may be adapted by the merest touch to give a perfect desk or piano illumination, with a minimum expenditure of electric current. The Franklin portable lamps are manufactured and sold by McDonald & Willson, Limited, Toronto.

Electrically Operated House Pump

The pump illustrated has recently been designed for pumping to open or pneumatic tanks for residence and similar services. The pump is of the single cylinder, single acting plunger type, the plunger being 1¼ in. in diameter and the stroke 2 in. The capacity is 160 gallons per hour. The driving pulley and crankshaft are supported by a column which is bolted to a base which supports the cylinder and

other parts of the pump. On the top of this column the motor is mounted. The motor which is of Robbins & Myers manufacture, is connected to the driving pulley by a flat leather belt. A weighted idler pulley provides the necessary belt tension. When for use in connection with pneumatic pressure storage tanks, the pump is equipped with an auxiliary air cylinder for pumping the air into the tank



above the water. This air cylinder is mounted above the water cylinder and is operated from the same crank shaft. The whole outfit is mounted on a base which occupies a floor space of only 16 in. x 24 in. This base has a receptacle for collecting oil and water, a drain pipe being provided for drawing off any water or oil so collected. The outfit is made by F. E. Myers & Bro., Ashland, Ohio.

Holtzer-Cabot Company in New Factory

The new factory of The Holtzer-Cabot Electric Company, on Amory Street in the Roxbury district of Boston, for which the ground was first broken on May 21st, 1914, has just been occupied by the company. The executive offices and factory, formerly at Brookline, have been moved to the new location, together with the Boston factories of the company, which were located on Albany Street and on Bristol Street, thus bringing under one roof all the departments of the industry.

The new factory consists of a main building 300 feet long by 60 feet wide, six storeys high, with an annex 100 feet long by 60 feet wide, 6 storeys high, and with a sub-basement 60 feet by 60 feet which is used as a garage. The boiler house is 42 feet by 42 feet, 20 feet high, with a 5 ft. 6 in. chimney 120 ft. high; the foundry building is 60 ft. by 60 ft., one storey high.

These buildings are grouped on a lot of land of approximately 250,000 square feet, located on Amory Street, Roxbury, and backing up on the shore line of the New York, New Haven & Hartford Railway. The construction is reinforced concrete with brick paneled walls on the outside and terra cotta partitions plastered on the inside, and is fireproof in the true and strict sense of the word. Woodwork has been entirely eliminated, with the exception of the few office partitions and finish on the second floor in the General Office. All other doors and door trim, hand rails, etc., throughout the manufacturing portion of the building, are metal or metal-covered.

Personal

Mr. R. R. Canfield, one time manager of the Sandwich, Windsor and Amherstburg Railway System, died recently at Sequin, Wash.

Mr. H. Hulatt has been appointed manager of telegraphs on the Grand Trunk Railway System, headquarters in Montreal.

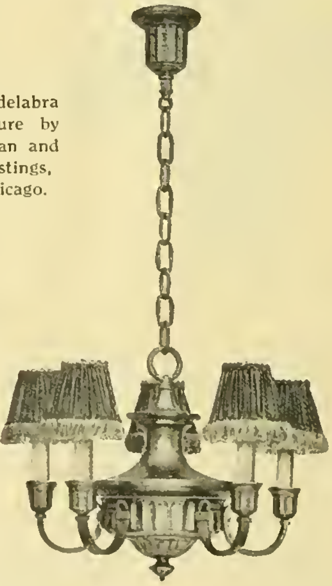
Mr. R. Ord, chief electrician of the hydro-electric plant at Mitchell, Ont., has resigned to offer himself in his country's service.

Mr. A. P. Linnell, chief assistant to Mr. A. B. Smith, manager of the telegraph department of the Grand Trunk Pacific Companies, Montreal, has joined the Princess Patricias and left for England.

Mr. Ernest V. Pannell, A.M.I.E.E., of the British Aluminium Company, Toronto, read a paper before the recent annual meeting of the American Institute of Metals on the subject "Recent Developments of Aluminium."

Mr. J. A. Vivian Rowe, late of the staff of the B. C. Electric Railway Company, has been gazetted as lieutenant in the Royal Engineers. He is now in training with his regiment in England and expects to cross the Channel shortly.

Candelabra Fixture by Moran and Hastings, Chicago.



Trade Inquiries

Name and address of enquirers may be obtained on application to the Electrical News, Toronto.

1083. **Press buttons.**—A Birmingham firm can place large orders for all kinds of press buttons. (Samples can be seen at the Department of Trade and Commerce, Ottawa). Prices should include delivery in Birmingham.

1092. **Accumulators, screws and bulls-eyes.**—A Birmingham firm is open to purchase 200,000 accumulators for pocket-flash lamps. They are also in a position to buy yearly 300,000 gross of brass and iron-wood screws principally ½-inch by 4-inch round heads (samples should be submitted; prices delivered Liverpool) and are prepared to place orders for large quantities of glass bulls-eyes for pocket-flash lamps.

1093. **Brass globe holders.**—A firm in England can place an order for one million brass electric globe holders. Quotations should include delivery Birmingham. (Samples can be seen at the Department of Trade and Commerce, Ottawa).

Current News and Notes

Dryden, Ont.

The town council is preparing a by-law which will be submitted in the near future to the ratepayers covering the purchase and installation of telephone equipment to the extent of some $5,000.

Edmonton, Alta.

W. E. Skinner, consulting engineer, Winnipeg, is acting as consultant for the city of Edmonton in connection with their agreement with the Edmonton Power Company.

The city council has accepted the offer of the Edmonton Power Company under the terms of which they agree to supply power to the city if given an exclusive franchise for a period of thirty years. In the early future the matter will be submitted to the ratepayers. The contract calls for a minimum yearly consumption of 25,000,000 kilowatt hours, to be paid for at the rate of 1.3 cents per kw.h.; this means a minimum yearly payment, whatever the consumption, of $325,000 a year. As the consumption of current in the city of Edmonton has never exceeded 22,000,000, and promises to run less than 20,000,000 this year, it is not likely that the citizens will consider the matter any too favorably. This is especially so as the present plant will also have to be maintained by the city so far as sinking fund and depreciation are concerned.

Hull, P. Q.

In connection with the remodelling of the City of Hull waterworks the Canadian Westinghouse Company have obtained an order for a 325-h.p. slip ring motor, direct connected to two De Laval pumps each of 8 million gallons per day capacity, to operate against a total head of 140 feet.

London, Ont.

The Utilities Commission has authorized General Manager Buchanan to call for tenders on three 200 kv.a., 13,200/575 volt transformers.

Montreal, Que.

Lieut. O. H. Linton, Montreal manager of the L. K. Comstock Company, has joined the No. 3 Overseas Battery Siege Artillery C.E.F., being raised by Major E. G. M. Cape.

The Eugene F. Phillips Electrical Works, Limited, Montreal, have secured a contract from the city of Ottawa for the new feeder cable from the central station to the pumping station. This is three phase, 13,200 v. paper insulated lead covered cable.

The electrical section of the Canadian Society of Civil Engineers will hold the following meetings at 176 Mansfield Street, Montreal, during the 1915-16 season; November 18 and March 2. Mr. R. M. Wilson, of the Montreal Light, Heat and Power Company, is president of the section, and Mr. Julian C. Smith, of the Shawinigan Water and Power Company, the vice-chairman.

It is reported that the directors of the Shawinigan Water

and Power Company are negotiating for the purchase of 100,000 h.p. which will be developed by the Laurentide Company, Limited, when their new plant is completed at Grand 'Mere, P. Q. The total amount of current developed will be 125,000 h.p., of which 25,000 h.p. will be retained by the Laurentide Company.

Niagara Falls, Ont.

The Hydro-Electric Power Commission have advised the city clerk of Niagara Falls that in case the ratepayers carry the hydro by-law the rate will probably be 3 cents per hundred square feet of floor area per month plus a 2-cent and 1-cent meter rate according to the standard scheme of computation. Commercial lighting will be 5 cents for the first 30 hours, 2 cents for the next 70 and .5 cents for all in excess. Power rates will be $1 per h.p. per month of connected load, plus 1.6 cents per kw.h. for the first 50 hours, 1 cent for the next 50 hours and .1 cent for all in excess. House and commercial lighting is subject to a prompt payment discount of 10 per cent. Power rates get a local discount of 25 per cent.

Renfrew, Ont.

It is understood that arrangements have been completed whereby Renfrew gets another manufacturing concern which will employ two or three hundred hands regularly and will require all the surplus electric power Renfrew at present can supply. The name of the new company has not yet been made public.

Reston, Man.

Preliminary steps have been taken towards the installation of an electric lighting system. The electors are strongly in favor of it and will authorize the council to take the necessary steps looking to the purchase of a suitable site and the installation of machinery.

St. Agathe, P. Q.

The town of St. Agathe des Monts, P. Q., is about to instal a sewage system, which will be electrically operated. There are to be two pumping stations containing motor-driven centrifugal pumps, by the current being supplied from the municipal power plant. The current will be stepped down from 2,300 v. to 550 v. or 210 v. Messrs. Ouimet and Lesage, Montreal, are the engineers.

Saskatoon, Sask.

The annual report of the Department of Railways of the province of Saskatchewan for the year ended April 30, 1915, is just to hand. That part of the report which is of interest to electrical readers includes statements with reference to the Regina Municipal Street Railway, the Saskatoon Street Railway and the Moosejaw Electric Railway Company, which operate respectively 30.53 miles, 16.28 miles and 11.5 miles of lines.

Selkirk, Man.

The electric department of Selkirk, Man., have announced that the rate for electric current will in future be 1.4 cents per kw.h. with a minimum charge of fifty cents per month.

Stratford, Ont.

Mr. F. C. Whatmough, electrical contractor, Stratford, Ont., recently received contracts in connection with the new showroom of the Imperial Rattan Co. and alterations to the store of the Barnsdale Trading Co., Stratford; also for the wiring of the residences of Messrs. H. Kalbfleisch and C. A. Moore of that city. Mr. Whatmough will also have charge of the wiring and illumination of the Public Library Building at Tavistock.

Toronto, Ont.

At the recent convention of the Ontario Municipal Association, held in Toronto, chief engineer F. A. Gaby, of the Hydro-electric Power Commission of Ontario, stated that requests had been received by the Commission from 300 municipalities concerning approximately 1,600 miles of electric railway lines.

60-Ton Gas-Electric Locomotives

The Minneapolis, St. Paul, Rochester & Dubuque Electric Traction Company, operating what is popularly known as the "Dan Patch" Electric Lines, has recently placed in commission three 60-ton gas-electric locomotives for freight, passenger and terminal service. These are somewhat similar in design although heavier than the 57-ton gas-electric locomotive which has been in successful operation daily on the company's lines for the past year or more from Minneapolis to Mankato, Minn. The four gas-electric locomotives, as well as thirteen gas-electric motor cars which the railway company has purchased to date, were designed and built by the General Electric Company. It is interesting to note that this is said to be the first railroad in the world operated entirely with gas-electric service.

The railway extends south from the company's terminal building in Seventh Street, Minneapolis, a distance of 107 miles to Mankato.

Lighting Schedule November, 1915

Courtesy of the National Carbon Company Cleveland

Date	Light	Date	Extinguish	No. of Hours
Nov. 1	5 30	Nov. 2	2 30	9 00
2	5 30	3	3 40	10 10
3	5 20	4	4 50	11 30
4	5 20	5	5 50	12 30
5	5 20	6	5 50	12 30
6	5 20	7	5 50	12 30
7	5 20	8	6 00	12 30
8	5 20	9	6 00	12 40
9	5 20	10	6 00	12 40
10	5 20	11	6 00	12 40
11	5 20	12	6 00	12 40
12	5 20	13	6 00	12 40
13	10 00	14	6 00	8 00
14	11 10	15	6 00	6 50
16	0 20	16	6 10	5 50
17	1 20	17	6 10	4 50
18	2 20	18	6 10	3 50
19	3 20	19	6 10	2 50
20	No Light	20	No Light	
21	No Light	21	No Light	
22	No Light	22	No Light	
23	5 00	23	7 20	2 20
24	5 00	24	8 10	3 10
25	5 00	25	9 10	4 10
26	5 00	26	10 10	5 10
27	5 00	27	11 10	6 10
28	5 00	29	0 30	7 30
29	5 00	30	1 20	8 20
30	5 00	Dec. 1	2 30	9 30

Total Hours 222.30

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Fighting Fire with the Electric

The most vital element in the success of fire fighting is promptness in responding to the call. The Philadelphia fire department state from their own experience that electrics are 300 per cent. faster than horse-drawn vehicles. These two statements combined appear to constitute an unanswerable argument in favor of the employment of electrically driven engines in every fire department where conditions are favorable for their use.

As between the electric and the gas propelled equipment the difference is not, of course, so great. The electric possesses advantages over its competitor, however, in that it is absolutely dependable in action and that it is much more easily controlled. The gas car under the most favorable conditions will occasionally refuse to work. In congested localities, again, the electric is easily shown to be more dependable. It can be more quickly accelerated and it has no engine to stall. Too many of our city councils appear to fail to realize that the matter of two or three minutes at the beginning of a fire would save, often, many thousands of dollars to the community. Many instances are on record where the saving from a single fire out of many that would occur during a short period would amply cover the extra cost of equipping the fire department with electrics. The cost of maintenance, also, though of minor importance, is worth consideration, as it is shown from actual operating data that this is less, varying, of course, with conditions, than where horse-drawn vehicles are employed. A valuable article covering this question is reproduced on other pages of this issue. An interesting section of this article refers to the experience of the city of Calgary where a number of electrics have been in service now for some two or three years. In this city electrics are used both for fire protection and for street cleaning purposes and in both cases have proven their worth to the entire satisfaction of the department heads.

Poorer Service or Higher Fares?

The rather startling statement made at the recent annual convention of the electric railway men in San Francisco that out of twenty-five electric railways in California only one declared a dividend during the past year brings home to us rather forcibly the oft repeated statement that the electric railway business is being run on a much closer margin than is appreciated by the public at large. There is, without doubt, an erroneous impression abroad that street railway companies and systems are making a great deal of money—hence the constant cry for better service and lower rates. Throughout the Dominion of Canada private capital has recognized this fact to such an extent that during recent years no very strenuous effort has been made to cover the field, which consequently has been left more or less to the municipalities themselves to care for. A study of the various systems, municipal and otherwise, in Canada shows a surprisingly small percentage at the present time making anything that looks at all like a profit. Deficits are decidedly the order of the day, particularly among municipal systems, which is not to be wondered at when one recalls the fact that municipal railway systems have chiefly been installed where private capital hesitated to venture in.

There is little doubt that if the better type of service which railway patrons are demanding is to be given by our railway systems, whether private or municipal, the rates charged for transportation must be appreciably increased. The dream of three cent fare, or less, must be given up. In the United States, where the railway systems are managed at least as well as our own, many roads operating under a straight five cent fare are doing barely better than paying actual expenses. The few exceptions to this rule, whether in the United States or Canada, can scarcely prevent the inevitable consequence of higher wages, higher taxes, and the demand for more frequent and more luxurious service which railway patrons are constantly making. This can only be met by higher fares. If the jitney does nothing more than this, it is probably bringing home to the average citizen the fact that an extra cent or two is neither here nor there where better service is concerned.

Battery Exchange Service

One of the most recent developments in electric vehicle work is that which is being put into practice in a limited number of cities in the United States whereby it is possible to change over your battery which has become discharged for a fully charged one—this service being available at different points throughout a given area. The system, of course, pre-supposes an active co-operation among a large number of supply garages and the central station company or organization in the neighborhood, so that the batteries may become standardized and also be made available at comparatively frequent points. Under this system the purchaser of an electric vehicle does not purchase a battery. He simply buys the vehicle minus any motive power in exactly the same way as the purchaser of a gas car buys his car without gasoline. Under a properly organized system the exchange of a discharged battery for a fully charged one at various points throughout the given city or municipality should be no more difficult and should consume no greater time than is now taken by the owner of a gas car

in having his supply of gasoline replenished. This scheme offers very promising possibilities which time and experience will doubtless turn into a reality greatly to the benefit of the electric vehicle industry.

Electric Fire Hazard

A short article appeared in a recent issue of the Monetary Times under the heading "Carelessness with Fire" which, quite unintentionally no doubt, gives an erroneous impression regarding the number of fires caused by electrical appliances. The item has reference to a report by Superintendent Gunther on British Columbia fires during the year 1914 and at superficial reading would, we think, leave one with the idea that all fires in B. C. were started from electrical causes. The paragraph referred to reads as follows:

"The causes of fires in British Columbia last year, on which the aggregate losses were $14,977, were discovered by Provincial Superintendent Gunther to be due to the careless handling of electrical appliances as follows:

Cause of fires	No. of fires
Electric iron, current not turned off	10
Electric curling iron, current not turned off..	1
Electric foot warmer, left in bed	1
Electric heater, too close to wall	1
Electric light, drop-cord hung over nail	1
Electric light, left in bed	1
Electric cluster, left on table	1"

As a matter of fact the report from which this data was taken gives a list of eight of the most frequent causes of fire, of which electrical appliances is, practically speaking, the least important. Of a total of 302 fires investigated 20 only were caused by the careless use of electrical appliances which the report attempted to classify according to the above list. This, in all reason, is more than enough for electricity, though only representing a little over 6 per cent. of the total number instead of the whole total as the article might be read to mean. Of the 20 fires caused by electricity the report makes it plain that 16, at least, were due to carelessness in handling." It is worthy of note too that of the total of 302 fires reported 235 were caused by stoves and furnaces. Electricity, even with careless handling, is placed in the same class as "spontaneous combustion," a cause of fire so rare as to almost constitute it a curiosity.

Lighting Equipment for St. Lambert

G. M. Gest, Limited, Montreal, have obtained the contract for the supply and installation of an electric lighting system for the town of St. Lambert, P. Q. This is the first section of a plan which will ultimately be considerably extended. Tenders were originally called for a five cluster light system, but after the opening of the bids it was decided to ask for new prices for 42 single nitrogen filled lights of 350 watts. G. M. Gest Limited quoted $4,250 and the Northern Electric Company $4,290; while the town engineer, Mr. E. Drinkwater, submitted a bid of $4,250. There are to be four circuits. Most of the wires, the supply of which is included in the contract price, will be carried in conduits, already constructed. The poles will be 12 feet high from the base to the centre of the light. The lights will be spaced an average distance of 150 feet on each side of the streets, and will be staggered. The system is controlled by a number of 50 ampere, 250 volt "Venner" time switches, each being operated by a 45-day clock of exceptional durability. These switches which are equally suitable for inside and outside operation are of a particularly high efficiency as the result of their system of mercury contacts which overcome all friction in the switch mechanism obviating the continuous troubles experienced in other types of switches. This time switch, due to its high efficiency and long service at one winding, is coming more into favor every day and their demand is rapidly increasing for both inside and outside use. They have been installed in this particular instance with a view to maintaining the high standard of workmanship prevailing throughout the entire system.

The Laurentide Power Company

It is proposed to incorporate a new company, the Laurentide Power Company, to take over and operate the Laurentide Company's new hydro-electric development at Grand Mere, P. Q. The Shawinigan Water and Power Company will, it is understood, be largely interested in the new concern, and will purchase a considerable amount of the 125,000 horse power to be developed. The Cedars Rapids Manufacturing and Power Company's earnings continue to increase. For the month of September they were $100,728, less $31,699 due to the Cedars Rapids Transmission Company and the Montreal Light, Heat & Power Company for transmission of power. The operating expenses were $3,528, and the fixed charges $33,996, leaving a surplus of $31,508. The gross revenue for nine months is $665,966 and the surplus $138,836. Work is now being carried out on the additional unit, including widening of the canal, an addition to the substructure of the power house and the installation of machinery. This will bring the capacity of the plant up to 110,000 horse power. A dam is also being built at the head of the forebay to lessen the danger of trouble from frazil ice.

Montreal Aqueduct Again

The Council of the Canadian Society of Civil Engineers have sent a second request to the Mayor and Commissioners of Montreal requesting the appointment of an independent board of engineers to investigate the scheme, partly carried out, for the enlargement of the aqueduct, the construction of a hydro-electric plant, and the building of a filtration plant. The hydro-electric section of the plan is the principal point of criticism, it being contended that it will be costly to construct and to maintain, and that the 10,000 horse power to be developed for pumping and lighting purposes can be purchased at a much lower cost from private companies. The Council of the Canadian Society ask that no further money be spent until the whole scheme is investigated, which would be in the interest of every engineer who has been connected with the project, the good name of the engineering profession and the interests of the ratepayers of the city.

Code Conference Postponed

The Bureau of Standards has announced the postponement of the conference that was to be held at Washington on Oct. 27 and 28, 1915, until a date to be announced later. This change of plans is due to the request of the National Electric Light Association, the American Institute of Electrical Engineers and the Association of Edison Illuminating Companies that additional time be granted for the consideration of the code of rules that has been formulated by the Bureau before they are submitted to a formal conference.

Sir Adam Beck, in a recent discussion of the power situation in Kingston, is reported to have expressed regret that the Commission had been unable to fulfil their promise of a power supply for that city. The Waddington power scheme, under which it had expected sufficient power could be obtained from this U. S. plant had been blocked by the United States authorities and no other source of supply is available at the present time.

Electrics in Universal Service

Already Economically Adaptable to Almost Every Phase of Transportation Work —The Newly-tried System of "Battery Exchange" Giving the Industry a Decided Impetus—Relative Cost and Operation Figures of Gas and Electric Cars

The Electric Vehicle Association of America held its sixth annual convention in Cleveland on October 18-19. The following interesting papers were read and discussed:—Industrial Trucks in the Service of the Pennsylvania Railroad Co., by Mr. T. V. Buckwalter; The Electric Taxicab, by Mr. I. S. Scrimger; Data on the Hartford Electric Light Company's Experience with the Battery Exchange System for Commercial Vehicles, by Mr. Willis M. Thayer; The Function of the Electric Garage, by R. Macrae; Comparative Development of the Commercial Power and Electric Vehicle Loads, by Messrs. H. H. Holding and S. G. Thompson; Problems We Are Facing and How They May be Met, by Mr. George H. Kelly; The Small Electric Vehicle and Its Application, by Mr. Charles A. Ward; Electric Vehicles in Municipal Service, by Messrs. Arthur J. Slade and R. Duval Dumont; Comparative Performance of Gasoline and Electric Vehicles in Similar Service, by Messrs. W. J. Miller and S. G. Thompson.

Two of the most practically important of these papers are printed herewith in copious extracts discussing the topics, (1) Battery Exchange and, (2) Electrics in Municipal Service. The idea of battery exchange is comparatively new, but entirely logical, and promises to solve many of the difficulties with regard to the care and charging of storage batteries—matters which the average private owner knows little about. Briefly it means that the electric garage, which may or may not be the central station in that particular place, sells a service to the owners of electric vehicles which includes both battery and electric current, instead of electric current only. The scheme has many advantages. It reduces the capital expenditure of the individual and so tends to stimulate the sale of electric vehicles. It removes the necessity of private charging outfits. It minimizes the danger of ill-treatment of the battery through improper charging. It means a very considerable saving in time where cells become discharged during the busy part of the day. Presumably a battery can be changed over as easily and as quickly as a gas car can be filled up with gasoline. Under the more favorable operating conditions the batteries will last much longer.

The second article deals with the use of electrics in various classes of municipal service, two of the most important of which are fire-fighting and refuse-collection. The author deals with the subject also under the headings. Police Patrol; Hospital Ambulance Service; Board of Education; Department of Water, Gas and Electricity Supply; Department of Public Works and Government Printing Office. The first two are of more practical interest to the average municipality and these only are quoted below. Evidently a much greater gain in operating efficiency can be obtained by operating the electrics longer hours—in the day for collecting refuse and in the night for street cleaning or for the transportation of collected refuse over long distances. Extracts from these two papers follow.

Battery Exchange System for Commercial Vehicles

By Mr. W. M. Thayer

The customer purchases trucks without batteries under the Battery Service System, as developed by the Hartford Electric Light Co. The company buys the batteries, charges and installs them in the customers' trucks. The equipment required by the company consists of batteries, the means for charging the batteries, and the apparatus for placing the batteries in the customers' trucks. The odometers on the trucks are also a part of the company equipment, with the cradles for the extra batteries. The "service" may be divided into two parts: the charging of batteries in cars at night and the charging of hatteries out of cars. For charging of batteries in cars the company have installed charging equipment consisting of a Rotary converter, having a capacity of 850 amperes at 250 volts, and a motor generator set, having a capacity of 800 amperes at 250 volts. Both of these machines are designed for operating on the three-wire system. This equipment is operated by employees of the company from 11 p.m. to 7 a.m. The arrangement of rheostats, etc., is the same as described later under the exchange station equipment.

For batteries not charged in the cars there are thirty-one sets of charging equipment installed. Each set is made up of one ammeter, one Sangamo ampere hour meter, one circuit breaker, and one switch. All batteries used on the service are Edison batteries of the standard size. All the trucks on the service are G.V.s, equipped with Universal cradles.

The Universal cradle is an underslung battery container, secured to the car by four hooks, one at each corner, and is removable in one unit by raising the battery about 2 inches, removing the hooks and detaching the battery leads. The vehicles are run into guides over hydraulic lifts for the purpose of removing the batteries. The hydraulic lift is made up of four cylinders, one at each corner of the platform, 3 feet by 6 feet. This platform in the lowered position is even with the floor. Each of these cylinders has an inside diameter of 6 inches and a maximum lift of 10 inches. Each cylinder is connected to the city mains by a 1-inch pipe. The opening of one valve of the city mains, places a water pressure of 60 pounds on each of these cylinders, which has proved ample to raise any batteries in use. The same pipe used for supplying water to the lifts is also used for discharging the water and lowering. This is done by closing the valve on the city main, and opening a valve on the discharge main. The original equipment contained a plunger valve on each of the four pipe lines to the cylinders. These valves have proved of small value. Each cylinder lifts the battery gradually into contact with the frame of the truck and automatically adjusts itself to varying heights of the truck frame from the ground, caused by worn or poorly distributed load.

Some form of platform truck is necessary for handling batteries when disconnected from cars. The Cowen truck used for this purpose has a height of 7 inches and is equipped with a platform which may be raised or lowered 1½ inches by the handle of the truck. The truck is placed on the plat-

form of the hydraulic lift under the car from which the battery is to be removed. The hydraulic lift raises the truck into contact with the battery cradle and raises the whole equipment high enough to permit the removal of the hooks which secure battery to body of car. When hooks are removed and wires detached, the battery is lowered and removed on the truck to the charging room. The raised platform of the truck allows the battery to be run over skids in the charging room. The battery is then lowered on to the skids and the truck removed for other work. The exchange station is equipped with two complete hydraulic outfits for exchanging batteries. A single equipment is capable of making the complete exchange of battery in three minutes, or less.

Charging Methods

No instruments are used on the cars except odometers All battery charging is based on the mileage covered with allowance for road conditions. When battery is removed from car the odometer reading is taken. The previous reading gives the miles covered and a slip is placed on the battery showing this distance. The man who places the batteries on charge uses this distance as the basis, multiplying same by a certain constant, depending on road condition, size of truck, etc. The Sangamo meter is set at the number of ampere hours required and runs back to zero, where the circuit breaker cuts it out. The voltage on individual cells is followed during the charging and serves as a check on the ampere hour meter.

Some power is saved in this way. The Sangamo meter, however, is practical and accurate, and is certain to take the battery off charge before excessive charging occurs. Batteries are cleaned with live steam at a pressure of 10 or 15 pounds. Distilled water is obtained from Barnstead water stills, operated electrically.

Operating Data

The introduction of "battery service" has tended to increase the mileage covered. The Boston Branch Grocery has a 1,000-pound car in use for 56 months, and has covered 46,760 miles, an average of 833 miles per month. The mileage of this car for July, 1915, was 1,012. C. N. Dodge has had a 750-pound car in service 46 months, and has covered 42,796 miles, an average of 930 miles per month. The miles covered by this car for July, 1915, were 1,293. The Eagle Dye Works Co. has operated a worm drive car for 9 months, and has covered 10,782 miles, an average of 1,198 miles per month. The mileage of this car for July, 1915, was 1,313. One of Gaffey's Express 1-ton cars has been in service 32 months and has covered 35,032 miles, an average of 1,095 miles per month. The mileage of this car for July, 1915, was 1,251. The City Coal Co. has operated a 2-ton truck for 8 months and has covered 7,998 miles, an average of 1,000 miles per month. This truck covered 1,110 miles in July. One of the first 1-ton cars received by the Hartford Electric Light Co. has been in service 62 months and has covered 50,844 miles, an average of 820 miles, per month. The mileage in July, 1915, was 1,031.

The record of cars and batteries for June, 1915, stands:

No. of cars	Size	Batteries	Ratio
11	750-lb.	17	1.54
22	1,000-lb.	34	1.54
28	1-ton	33	1.18
3	2-ton	5	1.67
Total, 64		89	1.4

During the month of December, 1914, cars on the road represented 1,432 car days, 1,284 exchanges of batteries were made, or 90 per cent. of the cars changed batteries every day. The number of cars stalled for any cause whatever was one for every 50 car days, that is, one car would get into difficulty every 1,450 miles.

During the month of June, 1915, cars on the road represented 1,594 car days, 988 exchanges of batteries were made or about 64 per cent. of the cars changed batteries every day. The number of cars stalled for any cause whatever was one car for every 477 car days, or the average car would get into difficulties once in every 14,310 miles. Twenty-four per cent. of the cars do not charge at night. The record of stalled cars includes every cause whatever, and does not necessarily imply exhausted batteries. An inexperienced driver might run his truck over into a back lot or over a bank.

The power used is measured by watt meters and includes all losses in transformation and stepping down.

For December, 1914:

Total power consumed was 57,856 kilowatt hours.

The mileage covered, 40,787.

The average power used, per mile, 1,418 watts.

For June, 1915:

Total power consumed was 50,414 kilowatt hours.

The total mileage covered, 47,615.

The average power used, per mile, 1,058 watts.

The Edison batteries used on the service are in some ways subjected to very hard use. The total number of cells in use at the end of the first period of three years, 5,094, and their service was the equivalent of 113,850 cell months. Seventy-six cells have been returned to the factory for repairs in these three years. Forty-four on account of leaks or broken seams. The balance of 32 cells for other causes such as failure to charge up or broken terminals.

Cost Recording

The accounts assigned to the vehicle and battery departments are arranged under the same general plan as all other company accounts.

The main accounts are carried under numbers and these accounts divided into sub-accounts, indicated by the main number, with—and sub-number. For instance, operating account is known as number 69, while operating labor under this account is 69—1. The accounts under battery service are divided as follows: The property account covering purchase of batteries; the property account covering purchase of service apparatus.

The operating accounts for the service are:

Operating Labor—This account includes labor for exchange of batteries, filling, charging, changing solution and shift labor covering the whole twenty-four hours of each day.

Operating Material—Includes distilled water, solution and any other material used directly for the batteries.

Repair Labor—The labor for actual repairs to batteries.

Repair Material—Any parts for repairs to batteries or any repairs made at factory.

Repair Service Apparatus—Includes labor and material for repairs to charging sets, extra Universal cradles, Odometers, Cowen trucks and all other apparatus used in handling batteries.

	Battery Service			3 year
Year ending	June, 1913	June, 1914	June, 1915	Total
Operating labor	$2,775.85	$ 9,381.16	$ 8,727.70	$20,884.71
Operating material ..	467.37	221.85	1,286.61	2,975.83
Repair labor	0.00	2.94	29.84	32.78
Repair material	76.94	102.42	313.71	493.07
Repair service apparatus	7.10	892.62	1,161.15	2,060.87
Power	520.33	1,904.83	2,833.37	5,258.53
Total of operating items	3,847.59	13,505.82	14,352.38	31,705.79
Income	5,513.88	18,559.07	26,559.13	50,662.08

On Basis of per Cell per Month

2,568 cells in use at end of first year, equal to cell months 13,332.

4,128 cells in use at end of second year, equal to cell months 43,536.

5,094 cells in use at end of third year, equal to cell months 56,982.

11,790 cells in use at end of three-year period, equal to cell months 113,850.

	1st year	2nd year	3rd year	3 year total
Operating labor	$0.2082	$0.2155	$0.1531	$0.1834
Operating material ..	0.0350	0.0280	0.0226	0.0261
Repair labor	0.0000	0.0002	0.0068	0.0029
Repair material	0.0057	0.0023	0.0055	0.0043
Repair service apparatus	0.0005	0.0204	0.0203	0.0181
Power	0.0390	0.0437	0.0497	0.0461
Total of operating items	0.2885	0.3102	0.2518	0.2793
Income	0.4158	0.4263	0.4661	0.4449

On Basis of per Car per Month

32 cars in service at end of first year, equal to car months 178.

46 cars in service at end of second year, equal to car months 521.

62 cars in service at end of third year, equal to car months 687.

140 cars in service at end of three-year period, equal to car months 1,386.

Year ending	June, 1913	June, 1914	June, 1915	3 year Total
Operating labor	$15.59	$18.006	$12.704	$15.068
Operating material ..	2.064	2.345	1.872	2.147
Repair labor	0.000	0.005	0.043	0.0237
Repair material	0.432	0.216	0.456	0.356
Repair service apparatus	0.039	1.713	1.690	1.496
Power	2.923	3.656	4.124	3.796
Total of operating items	21.615	25.923	20.891	22.876
Income	31.145	35.622	38.659	36.552

On Basis of per Average Mile

121,385 miles covered at end of first year
365,968 miles covered at end of second year
496,621 miles covered at end of third year
983,974 miles covered at end of three-year period

	1st year	2nd year	3rd year	3rd year total
Operating labor	$0.0228	$0.026	$0.017	$0.021
Operating material	0.0038	0.003	0.002	0.0031
Repair labor	0.00	0.00	0.0001	0.0000
Repair material	0.0006	0.0003	0.0005	0.0005
Repair service apparatus..	0.0000	0.002	0.002	0.002
Power	0.0042	0.005	0.005	0.005
Total of operating items..	0.032	0.036	0.028	0.032
Income	0.046	0.053	0.054	0.051

Future Extensions of the Service

Battery service would seem to overcome the weakness of electric vehicles caused by the limitations of battery capacity. This is true, but batteries with greatly increased capacity would increase the practicability of the battery system. A local truck owner recently ran nearly down to New Haven, a round trip distance of seventy miles. On the return trip a stop was made at Meriden and the battery given a boost, for which the truck driver paid 88 cents. The truck owner afterward asked if this 88 cents was not a part of the battery service for which he had already paid. This experience brings out the possibility of an arrangement with the central stations in surrounding towns under which any of the truck users could send their trucks on long trips and get boosts wherever necessary. The charge for battery service and a certain proportion of this bill charged to the customer. Should other central stations in surrounding towns adopt battery service, exchange of batteries could be made and the record handled very much as in the case of railroads using cars of foreign lines.

Electric Vehicles in Municipal Service

By A. J. Slade and R. D. Dumont

FIRE DEPARTMENT SERVICE

No municipal service presents such a complicated set of problems in mechanical haulage as does the Fire Department and yet it is the department which has been motorized, not only in large cities but in small villages as well, for a longer time and to a far greater extent than any other. All conceivable types and combinations of types of motive power and application have been used, most of them with success, and one system can not broadly claim superior advantages over another in view of the widely divergent service requirements. One community has a fire district covering many square miles; another is limited to a small area. One has excessive grades; another is comparatively level. One has heavy winter snow falls; another has a semi-tropical climate. One has high pressure pumping stations for its fire mains; another has not. One has many sky scrapers, district where hazardous manufactures are carried on, densely populated tenement districts of non-fireproof character; another has entirely different types of business and residential sections.

These variations from any standard which one may choose to assume, as may be done in the case of commercial merchandise transportation problems, necessitate the wide variations in type of apparatus and motive power which we actually find in use.

To intelligently determine on a motor propelled fire equipment, the existing local conditions must be investigated and analyzed, the existing horse-drawn equipment must be considered with reference to its utilization, and the organization of the department must be studied in its relation to the operation of the mechanical apparatus.

Among the varying conditions, instances are found where electric equipment has been installed and is giving satisfactory and economical service, notably the Philadelphia and Baltimore fire apparatus described in the paper presented by Mr. Walker at the 1914 E. V. A. Convention and the Springfield apparatus described in the discussion of that paper. Some recent figures furnished by the Philadelphia Fire Department on engine No. 20 both horse operated and electrically operated are as follows.

Horse-Drawn Apparatus

Engine No. 20, cost for 2 years

2 horses	$400.00
Forage	553.60
Shoeing	240.00

Depreciation	940.00
Repairs	600.00
Harness	96.00
Total	$2,829.60
Per year	1,414.80

Motor-Driven Apparatus

Same engine, electrically motor-driven maintenance for 2 yrs.

Current	$1,200.00
Repairs	480.00
Depreciation	922.40
Total	$2,602.40
Per year	1,301.20

The actual saving in cost of electric over horse operation appears to be only about 8 per cent. but its speed is nearly 300 per cent. greater a feature of vital importance in fire apparatus.

New York has a similarly equipped engine—No. 217—operating in the Borough of Brooklyn. The cost figures furnished by the New York Fire Department follow:

Engine No. 217. N. Y. C. F. D., Borough of Brooklyn.

1st Year May 1912—May 1913.		
Investment	$4,000.00	
Depreciation at 5 per cent.	$200.00	
Battery—mechanical repairs and renewals	70.84	
Current	117.90	
		$388.74
2nd Year May 1913—May 1914		
Depreciation at 5 per cent.	$200.00	
Current	117.84	
Battery renewals and repairs	410.97	
Mechanical and tire repairs and renewals	252.48	
		$981.29
3rd Year May 1914—May 1915		
Depreciation at 5 per cent	$200.00	
Battery and mechanical repairs and renewals	108.64	
Tire renewals	509.57	
Current	117.84	$936.05
Total—3 years		$2,306.08
Per year		768.70

The corresponding cost with horse operation (from article by Fire Commissioner Adamson, Power Wagon, Feb. 1st 1915).

Depreciation	$150.00	
Forage, veterinary, shoeing, etc.	750.00	
		900.00

The actual money saving here is nearly 15 per cent. without considering other advantages.

As an indication of relative speed in getting started the following figures are submitted:

Time from tap of gong to crossing of engine house door sill	4 seconds
Horse-drawn engine	6 to 10 seconds
Gasoline tractor	10 to 15 seconds

The electric and the gasoline are reported to reach the alarm box in the same time on account of the higher running speed of the gasoline vehicle and this illustrates the necessity of knowing the service conditions thoroughly (average distances to be covered, traffic conditions, etc.), in order to select equipment which will arrive at the scene of the fire in the shortest time.

The report of the Electric Vehicle Committee of the Incorporated Municipal Electrical Association (of England) presented by its Hon. Secretary, Mr. F. Ayton, M.I.E.E., under date of June 17th, 1915, refers to the equipment of "the London Fire Brigade which possesses a total of 15 electrically propelled vehicles, the oldest having been put into commission in 1911." Lieutenant Commander Sladen R. N., chief officer of the London Fire Brigade, is quoted as follows:

"The rapidity of turn out is absolutely unequalled by any other form of traction; it is not uncommon at an electric motor fire station under ordinary service conditions for a turn out to be effected in 7 or 8 seconds whereas with other forms of motors a good turn out is perhaps 15 seconds."

He gives some figures in regard to comparative costs of electric and petrol vehicles showing that for 800 miles annually the petrol machine cost $990.00 and the electric $942.00. The Liverpool Brigade has four electric vehicles in use since 1907, and among several continental cities employing electrics one (not named but probably Berlin) has 24 in service.

Many fire departments have a varying amount of general transportation work resembling closely ordinary commercial service, such as fuel supply to steam pumping engines, delivery of department materials and supplies or the work of the Fire Alarm Telegraph Bureau. The mileage of vehicles used for these purposes is within the safe operating mileage of the electric and the advisability of operating gasoline machines in such service as is now done in some departments may be questioned, on the ground of operating economy.

STREET CLEANING AND REFUSE COLLECTION

The use of motor vehicles and especially electrics in street cleaning operations has not yet become general, in fact may be considered to be in an experimental stage. The usual mechanical methods employed for cleaning streets are sweeping with rotary broom behind a water sprinkler to lay the dust; scrubbing with a rotary rubber squeegee in connection with a liberal water supply from a sprinkling tank which is a component part of the apparatus; flushing at 30 to 40 pounds water pressure from a tank supply, the nozzle pressure being obtained by a power driven pump, though in some instances a tank pressure is obtained when filling from the hydrants if the pressure in the water mains is sufficient. It is with this latter system that the limited number of electric street cleaners in North America have been equipped, and Canada probably has as many such vehicles as the United States. Few figures of operating cost are available, but it is obvious that as the duty of these electric vehicles is merely to transport gradually the diminishing loads of water, the economy is as great as that of any merchandise carrying electric for similar mileages. The time of filling is practically the same as discharging so that at 10 miles per hour during an 8-hour day a battery capacity of 40 miles per charge is all that is required. The use of a power driven pump would require a duplicate battery equipment with means for quick interchange as a discharge of 300 gallons per minute at 40 pounds would require about 10 horse-power allowing 50 per cent. combined efficiency of motor and pump, or 30 kilowatt hours extra battery capacity. With adequate facilities for recharging, boosting and interchanging batteries of various capacities so that weather, grade and pavement conditions can be compensated for it is not at all impossible that certain municipalities might find such a system very advantageous not only for flushing, but for sweeping and scrubbing, as well as for other operations.

Mr. Robert Mackay, superintendent of electric light, city of Calgary, supplies the following figures on trucks in municipal service in that city. See Table I.

It will observed that the mileage covered by these vehicles is very low being from 1/3 to ½ of their mileage capacity, and in consequence the cost per mile is high. Garage expense, drivers' wages, estimated depreciation (figured

TABLE I.—Figures on Calgary's Municipal Trucks

Capacity tons	1	1	3	3	5	5	5	1
Cost to date	1933.03	1955.85	2468.76	2417.52	2997.29	3033.54	2564.58	885.59
Average per month	214.78	217.32	274.31	268.61	233.03	337.06	284.95	177.12
Total miles..	7,176	7,061	5,080	5,375	4,581	5.855	5,208	1,475
Nos. in service	9	9	9	9	9	9	9	9
Cost per mile	0.2692	0.2769	0.4860	0.4516	0.6542	0.5011	0.4924	0.6004

at 20 per cent.) and similar fixed charges are distributed over too short a mileage to show marked economy. Nevertheless, Mr. Mackay states:

"Two 5-ton electrics in Street Cleaning Department effect a daily saving of $24.00 sprinkling and flushing during summer months. The sprinklers are operated in day and night shifts, of 9 hours sprinkling by day and 8 hours flushing by night at a saving of $24.00 per day of 17 hours over horse-drawn machinery. During winter months the tanks are removed and replaced by boxes which will hold 6 cubic yards of refuse.

"Calgary has 1,300,000 square yards of pavement, covering 54 miles of paved streets. The full equipment for keeping this clean consists of four-horse flushers, four-rotary brooms, two squeegees, five-horse sprinkling carts and two 5-ton electric trucks. In a test the two trucks used by the street cleaning department averaged 38 miles each per day of 9 hours sprinkling and 17 miles each per night of 8 hours flushing. The work cost $1.30 per truck for energy during the 17 hours.

"I might say that in addition to the two 5-ton trucks operated by the street cleaning department, we have a 1-ton truck used by the street railway department as a tower and for general construction work. Also a 1-ton truck and a 3-ton electric truck used by the stores department, for delivering materials for different departments, such as sewer department, public works and for handling stores material generally.

"One 3-ton truck is used by the water-works department. When this truck is used for moving water-pipe, a trailer is attached and loads consisting of six lengths of steel water-pipe, 20 to 24 feet long, 24 inches in diameter and weighing about 6 tons, having been hauled on this truck satisfactorily and with exceptionally good results, making economical transportation of this class of material. No hills of any size were encountered in these hauls, but for the greater part the haul was over ordinary dirt roads.

Truck Draws Three Trailers

"A 5-ton truck with an extra battery on the rear end of same over the back wheels, is used by the sanitary department, for hauling garbage. Three trailers are hauled, each trailer having a volume of 445 cubic feet. There is a rope network laid around the inside of these trailers. The garbage is drawn by one-horse carts to centralization stations where the trailers are left and are loaded as the carts bring in the garbage, and are picked up by the electric truck at certain times each day. When the trailers reach the incinerator the traveling crane picks up the rope network and dumps the load into the pit. This truck takes the place of six teams.

"The electric light department, have a 1-ton truck which is on the road an average of 18 hours a day, hauling material for construction work for line gangs, underground and sub-station construction. We also have a light steel tower which is placed on the truck and is used for trimming inverted magnetite lamps, on brackets, on street railway poles and standards. It is also used for patrolling certain circuits of arc lamps. We have a trailer we use with this truck for hauling poles. We have hauled on the 3-ton trucks, sixteen 35-foot poles, with 12-inch butt and 8-inch top, at a load. We have also loaded as many as eight 45-foot or 50-foot poles at a load. These poles were hauled over rough roads and up hills in all conditions of weather. One hill on this haul was 1,000 feet long and had a grade of 9 per cent., and just the ordinary dirt road which is almost impassible in wet weather. Still the electric truck was able to deliver its load."

The report of the Electric Vehicle Commission of England mentions an installation of 30 electric "watering vans" in a continental city not mentioned by name. The report states that "In the city referred to, each electric watering van waters about 49,000 square yards of road surface per day of 8 hours, as against 30,000 yards, the best average of horse-drawn van." The saving stated to result from employing "electrics" in place of horse-drawn vans for this purpose by the municipality mentioned is about $400 per electric van per year.

In the matter of refuse collection tests have been made in several American cities to determine whether house to house collection of ashes, garbage and rubbish, as well as collection of sweepings at street intersections where same is usually deposited, can be more economically performed by mechanically propelled vehicles than by horses and carts. While it is unquestioned that for this service the battery electric is more economical than the gasoline machine neither one has yet proved its advantages over the horse and cart, so far as the authors of this paper have been able to learn.

The interest on investment, amortization and other fixed charges appear to be too high to justify the use of motor vehicles for the limited mileage possible in this service, the restricted hours of operation, and the idle loading periods.

Relative Cost of House to House Collection

The Commercial Vehicle in its issue of August 14, 1914, gives details of the operation and cost of house to house refuse collection of a motor truck compared with horse trucks. The performance was personally observed by the investigator and the figures were taken from the records of the New York Street Cleaning Department. The figures are as follows and show that the horse cart cost is lower than motor truck cost:

Gasoline Truck

Gasoline	$2.415
Oil	0.746
Depreciation at 20 per cent	2.777
Interest at 6 per cent.	0.833
Repairs, labor and materials, tires, grease and miscellaneous	4.068
Garage rent	0.300
Driver's pay per day	2.560
4 helpers at $2.00	8.00
	$21.699

Horse Cart

Feed, oats	$0.407
Feed, hay	0.198
Straw	0.027
Hostlers and stablemen	0.382
Shoeing at $1.60 per mo.	0.053
Veterinary	0.019
Depreciation 6½ yrs., life at cost of $285.00..	0.122
Interest on horse at 6 per cent.	0.048
Wagon depreciation 6½ years life cost $123.00	0.053

Interest on cart at 6 per cent.	0.021
Harness depreciation $23.00 per set, life, 2 yrs.	0.032
Interest on harness at 6 per cent.	0.004
Stable rent	0.300
Wagon repairs and repainting	0.091
Driver per day	2,560
	$4.317

Gas car carried to dump 24 tons per day.

Cost per ton $0.92.

Same service could be obtained from horse-drawn vehicles for $0.799 per ton.

Upon withdrawing the motor truck from house to house service and placing it in transfer service with a crew of three helpers instead of four, made the total daily truck cost $19.69. It has been found that the work covers 54 miles per day, hauling a total of 26.6 tons or $1.03 per ton. The cost of transporting an equal tonnage for the same routes by horse and cart is $1.56, an increase of more than 50 per cent. over the motor truck cost.

These opinions are concurred in by the English report quoted as follows:

British Experience

"It should be obvious that in replacing horse-drawn vans and carts with motor vehicles, no matter whether they be petrol, steam or electric, the latter will show the best results where the refuse destructor is at a distance from the area of collection, the saving, of course, being in the high speed at which the motor vehicle can traverse this distance, and its greater carrying capacity. It is quite possible, on this account, that, in some towns, the best economy might be obtainable by a combination of ordinary horse-drawn vehicles for the districts in propinquity to the destructor, with the use of electric vans for the districts further away. Possibly in the latter districts, also, the local collection could be best done by horse vehicles conveying the material to a central depot from whence it would be transported to the refuse destroyer by large electric vehicles. An arrangement of this latter sort has been in successful operation in a large continental city for some time. The horse carts are provided with removable box bodies, so that when the cart arrives at the depot, the body is lifted off it by an electric crane, and placed upon the flat platform of a large electric vehicle, which when it has received its full complement of these full boxes, proceeds on its journey to the destructor. In the meanwhile empty box bodies are placed upon the tumbrils which once more proceed upon their rounds of collection."

In opposition to this view however the same report states:

"Electric vehicles have been employed to a considerable extent on the Continent for refuse collection. The largest installation is in Paris, where the municipality possesses a fleet of 100 electric refuse collecting vehicles. Each has a capacity of a little over 15 cubic yards to the ton, makes the total load of the full vehicle not less than 5 tons. The vehicles perform their work during the night hours, each covering about 25 miles nightly, with an energy consumption per vehicle mile of from 1.5 to 1.7 units. This system of collection was adopted as the result of a very careful trial made by the civic authorities which showed that considerable economy would be obtainable by the use of electric vehicles.

"It is satisfactory to be able to record that, as the result of a trial of electric vehicles for refuse collection, the Urban District Council of Barnes has placed an order for four vans. The following information is extracted from an instructive report submitted to the Council by its Surveyor, Mr. G. Bruce Tomes.

"It was found that one electric van would do the same work per week as that now done by sixteen horses and carts employed on refuse collection.

"The cost of the type of electric van decided upon, complete with battery and electrically driven tipping gear, is $4,725. The gear takes from 10 to 15 seconds to tip, and the speed of the van on the level is about 10 miles per hour, with a total mileage capacity upon one charge of 40 to 45. The capacity of the van is 4½ cubic yards, which compares with the 2½ yards of the present cart.

"As a result of careful tests, Mr. Tomes found that the cost of operation came out at $4.74 per van per day, which figure covered interest upon cost of vehicle, as well as its share of the charging equipment, repayment of loan on both of these items, wages, electricity, tires, maintenance of battery and chassis, insurance, lubricants and sundries.

"The comparable figure for a horse and cart is $2.75 per day.

"Basing his estimate upon the figures obtained by the trial of the electric vehicles Mr. Tomes reported to his Council that the replacing of the existing horses and carts by four electric vans would, notwithstanding a capital expenditure of $20,000 on the vans and charging plant, result in a saving of at least $2,000 per annum.

"A similar trial made by the surveyor of the Heston and Isleworth Urban District Council resulted in the Council placing an order for an electric dust van. The trial was specially interesting from the fact that experiments were made with three types of automobiles (namely; electric, steam, and petrol) in order to determine the one best suited for this work. The electric van's safe load was 2.68 tons; it had a motor tipping body. The Garrett steam wagon had a capacity of 3 tons, and the Thornycroft petrol wagon could carry 3.2 tons. It was found that any one of the three motor wagons could do the same work as previously done by four of the Council's horses, but in point of saving in cost over horse haulage, the electric vehicle showed a saving of $355, the steam wagon $330, and petrol wagon only $1.89 per annum. The report of the Works Committee to the Council concludes by stating: 'After careful consideration of the whole matter, the Committee have come to the conclusion that an electrically propelled vehicle would be the best and most suitable for the purposes of house refuse collection.' It is interesting to note that the purchase costs of the three types of vehicles were: electric, $4,200; steam, $3,085 and petrol, $4,075; the estimated annual costs of working, including capital charges, being given as $1,665, $1,690, $2,020 respectively. While the results in working cost for the steam wagon are a near approach to those of the electric, the surveyor notes that the 'driver of the electric vehicle does not need any mechanical knowledge, an ordinary intelligent carter being quite able to perform the duties of driver;' while, in regard to the steam wagon, he remarks: 'as is well known, a good driver is not always obtainable, and can only be discovered by the experience gained by the cost of repairs.'

Birmingham Figures

"In December of last year some interesting trials were made of the use of electric vehicles for the collection of house refuse in Birmingham. The trials are dealt with in an excellent report presented to his committee by Mr. Jackson, the Superintendent of the Refuse Disposal Department, wherein he sums up the results in the following paragraph:

"The three tests confirmed my opinion that electric vehicles have established themselves sufficiently to justify municipalities giving their support, perhaps, at present in a somewhat limited degree, to their development."

"As a result the Birmingham Corporation have placed an order for two electric refuse collection vans.

"Dover is another place where electric vehicles are about to be used for the collection of house refuse, the Corporation having, as a result of a trial of an Edison vehicle of 2 tons capacity, decided to order six such vehicles. A con-

siderable annual saving is anticipated by the change in system."

In none of these cases are we informed of the existing local conditions and since no two municipalities have identical conditions a careful study and analysis should be made to determine; 1st, the requirements of the service to be performed and 2nd, the design of vehicles best suited to perform this service.

Prominent phases of the problem to be investigated and analyzed include:

Method of final disposal.

Traffic conditions and the limitations on design effected thereby.

Living conditions and effect of characteristics of inhabitants on motor vehicle design.

Effect of variation in weather conditions.

Seasonal variations in qualities of different classes of refuse.

Type of street pavements and variations in grades.

Functions required of the equipment.

(a) Refuse collection and transportation.

(b) Cleaning streets.

(c) Snow work (plowing, sweeping or carting).

An investigation along these lines in one of the districts in New York resulted in the design of a tractor trailer system, now being installed in service, by which house to house collection and transportation to point of disposal will be performed by day and various street cleaning operations at night. Thus the tractors will be operated on two shifts with different types of trailers and the saving over present methods will be substantial. While the conditions in the district in question and in other districts to which the system may later be extended led to the adoption of gas-electric tractors, it is highly probable that in many municipalities the storage battery electric would prove to be the solution, especially with a battery interchange system.

Data from New York

As comparing the relative economy of electric and gasoline operation on transfer work, the following data has been obtained from the New York Street Cleaning Department on a 5-ton electric tractor and a 5-ton gasoline tractor, and estimates of operating costs of both machines have been made, based on this information:

5-Ton Electric Tractor, and 5-Ton Gasoline Tractor, Department of Street Cleaning, City of New York

The electric operates from stable at Flushing and Kent Aves., Brooklyn to Utica Ave. and Pacific St., Brooklyn. Round trip 7 miles, time 1 hour, 10 minutes. Pulls trailer carrying from 14,400 pounds to 18,800 pounds. Repairs to electric tractor since beginning of operation, none. Renewals only on tires. Trailer has had several minor repairs. Makes five trips per day. Load equals six to eight carts. Gasoline tractor from same stable, makes trip with same load in 1 hour, 5 minutes. Breaks down frequently. Below is an estimated comparison of operating figure.

Gasoline

Depreciation at 20 per cent.	$960.00
Interest at 6 per cent.	288.00
Maintenance	420.00
Tires	656.25
Gasoline	471.00
Oil and grease	131.25
Total cost yer year	$2,926.50
Total mileage annually	10500.0
Cost per ton mile	$0 0743

Electric

Depreciation at 10 per cent.	$450.00
Interest at 6 per cent.	270.00
Battery renewals and repairs	399.00
Mechanical parts upkeep	189.00
Tire renewals and repairs	336.00
Electricity at 0.05 per kw. hr.	543.00
Oil, water, etc.	40.00
Total cost per year	$2,227.00
Total cost per year	10500.0
Cost per ton mile	$0.0565

A saving of approximately 40 per cent. per ton mile.

Electric-Furnaces in the Steel Industry

Electricity Cannot Yet Compete, As to Cost, With Fuel Burning Furnaces, in Reduction of Ores—Quality of Product However is Higher—Chief Application as Yet, in Melting Scrap Steel to Make Ingots or Castings

At the meeting of the Montreal Metallurgical Society held on October 13 at McGill University, the question of making electric furnace steel in Canada was discussed, and some very interesting information was given as to the progress of the industry. Dr. Alfred Stansfield, the president, introduced the subject and stated in part: The electric steel furnace is a furnace in which steel is melted and refined (or melted merely, or refined merely) by means of heat obtained by electrical energy instead of by burning coke or other fuel. The convenience and efficiency of the electric furnace has always been granted but the high cost of electrical energy has been a serious difficulty.

Electric furnaces are more efficient than most fuel burning furnaces, and it can easily be shown for example that it will be cheaper to melt steel in an electrical furnace than in the old fashioned crucible in its coke fire melting hole. The open hearth furnace however can melt steel with about 600 lbs. of coal per ton of steel, and that is a figure which cannot be approached by the electric furnace at ordinary prices of electrical energy and coal. It is therefore obvious that the electric furnace cannot replace the open hearth for large outputs of steel, except possibly for some products of very special quality. It has been discovered, in recent years, that for certain classes of work, such as the production of small steel castings, the cost of the fuel (or electrical energy) forms a less important item in the whole cost of the process than had been supposed, and that the greater convenience and simplicity of the electric furnace make it actually cheaper than the open hearth furnace under certain conditions, while the product is often decidedly superior.

Electric furnaces have been in use commercially in some Canadian foundries for a year or more, and now that the Armstrong Whitworth Company are erecting one in their Longueuil plant it seems opportune to review the work which has been done and to emphasize the possibilities in this direction. I am of course not considering the electrical smelting of iron ore to make pig iron. This is a commercial operation in Sweden where I saw the furnaces a year ago.

I am not considering either the smelting of iron ore to make steel because it is not as yet in commercial operation in this country. The main subject of the evening is the melting of steel scrap in the electric furnace to make steel ingots or castings. At least three Canadian firms are now doing this commercially and find the electric furnace more profitable than the open hearth for their particular lines of work.

The electric power required to melt steel scrap, assuming that no refining is needed, will vary from about 600-900 kw. hours per 2,000 lbs. of steel. If this is charged by the meter at 2/3c. per unit, the cost would be from \$4 to \$6 per ton, or 0.3c. per lb. of metal; a figure that is not at all unreasonable when turning out a high class product. In a paper published last year by Mr. C. A. Hansen, particulars are given of a two-ton arc furnace in the foundry of the Treadwell Engineering Company at Easton, Pa. This company had been melting steel in crucibles using oil at 2½c. a gallon, and found that the cost of melted metal from the electric furnace was less than half that from the crucible plant. In this foundry the furnaces are not operated continuously but only on the day shift. When making one heat per day, starting with the furnace cold, they required 7-7½ hours to turn out a charge, and used 1,050 kw. hours per 2,000 lbs. of steel, while subsequent heats could be made in 4½ hours, using 630 kw. hours per ton of steel in the ladle.

At a time when they were making fifteen heats of 4,600 lbs. each per week the costs per ton of steel were found to be:—

Power consumption (900 kw.h. at 2/3c.)	\$6.00
Repair costs	2.50
Electrode costs	2.50

The scrap steel, at \$10 a ton, would cost say \$11 per ton of steel, making a cost for these four items of some \$22 per ton of ladle steel.

Mr. Hansen explains that the steel at the Treadwell foundry is poured very hot and that this increases the power, repair and electrode costs, and that a similar furnace pouring rather colder metal costs as follows:—

Power consumption (725 kw.h. at 2/3c.)	\$4.80
Repair costs	1.30
Electrode costs	2.15

In giving these figures for consideration. I have set the cost of power at 2/3c. per kw. hour, as I understand that it can be purchased for foundry work at that rate. 2/3c. a kw.h. corresponds to \$58 per continuous kw. year or \$43.50 per E.h.p. year. It is known of course that power can be purchased at say \$15 per E.h.p. year, which is only one-third of the above, but this price would be charged whether the current was used or not, and if the furnace only ran during the day time it would not actually consume more than about 1/3 of the the power paid for.

In Sweden, where I saw the Rennerfelt steel furnace in operation, the power was used to run machinery in the day time and the electric furnace at night, thus enabling them to make efficient use of continuous power. The conditions of the purchase of power and the load factor of the furnace would both have to be considered in making an economical use of an electric furnace in the foundry.

In comparison with the figures that I have already given I have secured a number of cost data for making electric steel in the new Snyder furnace. (Electric furnace costs by F. T. Synder, Proc. Amer. Electro Chem. Soc. 1915). This furnace turns out 5,000 lbs. of steel at a time, but is able to make this amount of steel four times in a day shift of eleven hours. The cost for electrical power is a little less than the figure I have just given, but notable savings have been effected in the matter of repairs and electrodes. These economies are apparently due mainly to improvements in the furnace design which result in decreased heat losses, and in the ability to produce heat more rapidly in the furnace in proportion to its size, and thus to turn out the heats more rapidly and to do this without injury to the lining of the furnace itself.

Electric Steel Melting

Costs of operation when melting cold scrap at 10-ton output.

Output:		Per Day	Per Ton
Heats in 11 hours		4	
Tons of metal in hours		10	
Labor:			
Melter	\$4.00		
Helper	2.50	\$6.50	\$0.65
Electricity (.7c. per kw.h.)			
Furnace	34.70		
Substation	4.00	38.70	3.87
Supplies:			
Refractories	3.00		
Electrodes	6.00	9.00	.90
Maintenance		2.40	.24
Direct cost		\$56.60	\$5.66
Burden:			
Interest, depreciation and taxes		18.00	1.80
Conversion cost		\$74.60	\$7.46
Charge:			
Scrap	\$110.00		
Alloys	6.00	\$116.00	\$11.60
Total cost melted metal		\$190.60	\$19.06

Electric furnaces used in steel making are either arc or induction furnaces. The induction furnaces, while keeping a steadier load, are more costly than the arc furnace for the same output, particularly if low frequency generators are required as is sometimes the case.

Mr. Stansfield then described, with the aid of lantern views, the Heroult, Girod, Stassano, Rennerfelt and Snyder furnaces, pointing out the methods of construction and of steel making.

Mr. J. E. Davey, of the Canadian Brake Shoe Company Ltd., Sherbrooke, P. Q., described the construction and operation of four 3-phase electric furnaces each of 5,000 pounds capacity and one of a ton capacity installed at the works, the four turning out steel for ammunition purposes. From the commercial standpoint, he said, steel electrically made was handled by less experienced men than any other kind. The open hearth process was generally hard to beat, but when it came to converting certain descriptions of scraps into given kinds of steel, the electric furnace held its own. Mr. Davey then referred to the difficulties in building their first furnace, and proceeded to say that it took about 4½ hours to convert 5,250 pounds of scrap into 5,000 pounds of steel. They received current at 6,600 v., which was transformed to 70 v., and after the breaking down of the scrap by the current, there came the process of refining. While the transformers operated at 70 v., they also were capable of working at 40 v. and 110 v., but 40 v. was too low, and at the higher voltage there were difficulties in controlling the furnace. The ideal voltage was 60, to be gradually stepped up to 90 v. The company were using about 600 kw. hours per ton of molten steel. The cables were brought in overhead, and he was satisfied that this method was preferable to laying them in conduit, where they were liable to trouble which could not be seen. They located the transformers as near the furnaces as possible. The refractory cost was \$2.60 per ton and the electrode cost \$2.70 per ton. The company were about to install the Snyder single phase furnace, which was guaranteed to give ten heats of 2 tons every 24 hours. It depended on the cost of power whether one could operate a three phase furnace at a profit. The one ton furnace was used for manganese steel. The furnaces at

(Concluded on page 37)

The Trend of Recent Electrical Progress

A brief review of the past with a conservative prophecy of what the future has in store—Progress, stability and permanence (Concluded)

By Mr. P. M. Lincoln

The hysteresis and eddy current losses that take place in irons and steels that are subjected to varying magnetic fluxes constitute another of the limits encountered in the design of electrical machines. Marked progress has been made in this respect in recent years. Our modern transformer steels in the matters of losses and iron ageing qualities show a vast improvement over those formerly available. Unfortunately, these improvements have so far been accompanied by a decrease in permeability which is highly objectionable, particularly in rotating machinery. Unquestionably, further improvements will be made in the magnetic qualities of our irons and steels, but these improvements will probably make no revolutionary change in the costs of electrical apparatus.

The conductivity of copper and other metals is another physical property that sets a limit to the output and cost of our electrical apparatus. Apparently we have reached a definite limit in this respect. The conductivity of the copper of commerce is within an extremely small percentage of that of pure copper and we cannot expect to obtain a higher conductivity in copper than that of purity. There remains, of course, the possibility of using some metal other than copper, but at this present time there is very little promise in that possibility. There is apparently no metal that even approaches the space and cost characteristic of copper that makes it so essential to the construction of electrical apparatus. Aluminium is a competitor only when the volume of the conductor is not an essential element in design, as a transmission line and the like.

Output and Temperature

One of the most pressing of our existing limitations to a reduction in cost of electrical apparatus is that fixed by temperature rise. The output of a piece of electrical apparatus increases with the temperature rise, and the temperature rise in turn is dictated by the point of balance between the rate at which heat is put in and that at which it is taken out of a machine. The rate at which heat is put in depends largely upon such physical characteristics as hysteresis and permeability of iron and conductivity of copper, which characteristics are already being crowded to the limit by our modern designs. The rate at which heat is dissipated depends upon the efficacy of the ventilation methods used, and in this particular there is a considerable opportunity for improvement. The methods and devices for taking heat out of machines are just as important, when considering temperature rise, as the prevention of heat from entering. While there is unquestionably room for considerable improvement in this particular, there is a question as to whether it will cause any material reduction in the cost of such apparatus. The additional cost of applying the more efficient methods of dissipating heat will go far toward nullifying their tendency toward a reduction of cost.

However, there is one line of development that does promise some reduction in cost, and that is the tendency toward higher operating temperatures. In the past, the maximum operating temperature has been fixed by the disintegrating point of fibrous insulation, and this point has placed a very definite and logical limit to temperature rises in such machines. However, when types of insulation are used which do not have this definite temperature of disintegration, this reason for such a temperature limit disappears. Just how far we can go in apparatus temperatures without exceeding the safe limits of these heat-resisting insulations is as yet problematical. However, a limit to an indefinite extension in this direction is set by the temperature coefficient of copper conductors, the property that causes the resistance to rise with increasing temperature, thereby causing still higher losses and in turn still higher temperatures. If we go high enough, we will reach a point of unstable equilibrium in this temperature rise curve, where the apparatus will literally and automatically "burn out." This point is, of course, far above anything that is projected at the present time, but while we are looking for limits, we might as well recognize that such a one exists.

In the matter of power production, therefore, although we have steadily improved in the past, both as to costs and as to performance, and although we may expect to continue this steady improvement in the future, we must not expect that these improvements will be of the same revolutionary character as they have been in the past. We can see ahead of us a definite limit beyond which it will be impossible to improve the methods of power production now in use. I do not mean to say that there will be no new or revolutionary methods developed in the future, but so long as we continue to get our power from falling streams and burning coal, we need not expect to see the same radical improvements in the future as have distinguished the past. To illustrate my point more fully, let us consider the nature of a water power. Water is evaporated by the action of the sun and is carried miles above the earth into the clouds. Here it is precipitated in the form of rain or snow and falls on the earth. The streams carry this water back to the ocean and it is then ready to repeat the cycle. Our existing water powers utilize an almost infinitesimally small part of this water over an almost infinitesimally small part of the total height to which the sun carried it. Insofar as is concerned the water we use over the head through which we use it, we do fairly well, but the part of the sun's energy which we thereby realize is so infinitesimally small that it puts us to shame. Some Westinghouse or Edison of the future will show us how to use the sun's energy directly. The point I wish to make is that the revolutionary improvements in power production methods of the future must come in a fundamental change of method rather than in the continued improvement of existing methods.

So much, then, for the methods of producing power. In the matter of utilization of power a few comparisons with the past may not be amiss. As indicated early in this address, the modern motor has reached a stage, insofar as efficiency is concerned, such that little improvement may be expected. We are within a comparatively small percentage of perfection in this respect. The progress of the future will undoubtedly come from improvements in methods of application, and in this direction the field is inexhaustible. For instance, the problem of applying electrically the large amounts of power which are demanded by our modern railroad trains has not yet received a solution which is satisfactory to all concerned. That the problem will be solved there is no doubt in my mind, but just how, is a question that I do not propose to discuss in this address. However, this is only one of the many problems that confront the electrical engineer. The devising of methods for the application of electricity to our modern industries constitutes the occupa-

tion of no small part of our fraternity; as witness the many pages in our Proceedings that have been occupied during the past years by the activities of the Industrial Power Committee. It is along this line that we may expect much of what the future may have to offer us of a revolutionary character.

Progress in Lighting

In the field of electric lighting there have been developments of importance. After the telegraph, in point of time, the electric light was the first practical application of electricity.

Most of our modern development in electric engineering has taken its initiative from the supply of electric lighting to our communities. In this matter of electric lighting let me quote again from Kennelly's 1898 address: He says. "The price of a 16-candle power incandescent lamp 16 years ago was about $1.00. Now it is about 18 cents. The best lamps at that time, under laboratory conditions, gave about 0.28 mean horizontal normal British candle power per watt, and under commercial conditions about 0.20. The highest pressure for which they could then be obtained was about 110 volts. At the present time, lamps are obtainable giving normally 0.4 mean horizontal British candle power per watt, while under commercial conditions the average lamp normally develops about 0.25 candle per watt. They can also be obtained (at 0.25 candle per watt) for pressures up to 240 volts, and are frequently installed on 220-volt mains."

Kennelly therefore records an improvement in 16 years of about 50 per cent. in cost of lamps to the consumer and about 50 per cent. in efficiency. The introduction of the metal filament lamp has enabled us to-day to record a much greater rate of improvement in efficiency than Kennelly did. He reported an improvement of about 50 per cent. in efficiency in the 16 years previous to 1898. In the 17 years since Kennelly wrote, we have improved our maximum efficiency about 1000 per cent., an advance which is truly marvellous. But here is a field where we have a long way to go yet without reaching a possible limit. It is true that the melting point of the now available materials seems to place the limit of lamp efficiency at a point not much higher than that which we have at present. However, when we come to compare the efficiencies of even our best lamps with that attained by the fire-fly it is evident that we still have a long way to go before we have reached perfection.

Power Transmission

In the matter of power transmission, progress during the past few years has been remarkable. In 1898 the record reads:—"The electric transmission of the power of falling water is a branch of engineering that has come into service since 1884, and is making rapid strides, owing to the recent successful employment of high voltages and multiphase alternating currents. It has been estimated that about 150,000 kw. of this class of machinery is installed on the North American continent, commercially transmitting power to various distances up to 85 miles, at various pressures up to 40,000 volts." Since Kennelly write, 17 years ago, the maximum transmission voltages have gone up about 3¾ times, 245 miles as against 85, and the installed capacity of water plants on the North American continent about nine times, 1,350,000 instead of 150,000 kw. Kennelly also mentions in his record that "insulation testing sets have been made for producing alternating pressures up to 160,000 volts effective." In this respect we can go at least 10 times better than he reported, 1,000,000 volts from transformers having been made available on more than one occasion, and in some cases the voltage available from transformers has been pushed even higher. This matter of power transmission is a branch of our industry wherein the progress of the last 17 years since Kennelly made his record has advanced with probably greater rapidity than in any other branch. I feel very sure that the president of the Institute who comes along 17 years hence and compares the then conditions with my record will not be able to claim any such advance as that we now may claim over 1898. This follows because we are approaching some fairly well defined limits in these matters. For instance, in the question of increasing transmission voltages we are close to the corona limit. The appearance of corona in the transmission line means the continual loss of power and therefore corona cannot be tolerated to any appreciable degree. There are, of course, methods of increasing the voltage range somewhat before corona is produced, such as increasing conductor diameter, but it can be readily seen that the limits of such remedies will be reached long before transmission voltages have increased by the same ratio as they have in the past 17 years.

An Economic Limit

Another limit that we are approaching in the matter of power transmission is the economic one. Transmitted power costs more than that generated at the point of delivery on account of the cost of and the losses in the transmission line. There obviously is a limit to the investment that can be made in transmission lines and still be able to supply power with the same economy as it can be generated upon the ground. This consideration, coupled with the rapid advance in methods of generating power from steam, has in my mind placed an economic limit to the transmission of water power so that we cannot expect any such advances in the future as the past 10 or 15 years have given us. That there will continue to be improvement and advance, no one can doubt, but its rate will certainly be deminished. Transmission by high-voltage direct current has received some attention of recent years. While there is no question but that the problems of pure transmission are much simplified by the use of direct current, the accompanying problems of the generation and utilization are so much intensified that nothing is to be gained in this manner. I would predict no material advance for the future in direct-current transmission of power unless some means, as yet undeveloped, is found by which its generation and utilization are made easier and safer than is possible at present.

Always Progress

And so we might go on indefinitely and draw comparisons with past practices. Always we find progress, always also we find that the rate of progress is not so high now as it was in previous years. This is but the working out of a natural law. Electricity is no longer the infant that it was formerly pictured, and cannot be expected to continue the rate of growth of the infant. It is attaining the vigor and strength of manhood. It is contrary to natural law that either a child or an industry can have rapidity of growth and at the same time strength and stability of character. Unquestionably the rapidity of our development is not so great now as it was when Kennelly spoke in 1898, and in this respect we are but following a natural law. At the same time, our vocation is acquiring a stability and permanence that are absolutely incompatible with the rate of growth that characterized its earlier years.

Franchise By-law Defeated

On October 16 the electors of Walkerville defeated a by-law granting an extension of their franchise for twenty years to the Sandwich, Windsor and Amherstburg Railway Company. This result is attributed largely to the fact that a plan has been proposed by the Hydro-electric Power Commission of Ontario for serving the border towns in this district by a municipally owned electric railway system.

Electric Railways

Installation of Car Meters Effects Gradually Increasing Economy in Current Consumption—57.5 Watt-Hours Per Ton-Mile a Very Low Figure

Some interesting figures on the savings effected by the New York, Westchester and Boston Railway by the use of watt-hour meters installed on the cars are given in a recent issue of the Electric Railway Journal. The energy consumptions per car mile, as indicated, include the power that is used for all miscellaneous purposes, as well as for propulsion of the cars. This covers the operation of the auxiliary equipment, the heaters, the lights and the transformer blowers, which are kept running continuously when the atmospheric temperature is above 80 deg. In addition, the power used in switching the cars about the storage yards and in testing them after inspection is reported as part of the overall energy consumption, and it is estimated that the minimum figures obtained in the summer time, when no heaters are used, represent approximately 10 per cent. more power than is actually consumed by the propulsion of the cars.

The low record for the summer of 1912, it may be said, was 8.2 kw.-hr. per car mile, this being made prior to the establishment of the present system of competitive records for individual motormen which are made up from readings of the wattmeters on the cars. During the summer of 1913, after the competitive records had been put into effect, the low figure was 4.5 kw.-hr. per car mile. In 1914, as shown by the accompanying table, the record was reduced to 4.33 kw.-hr., and in 1915 it was brought down still further to 4.15 kw.-hr.

Table Showing Average Car-Mile Energy Consumption by Months. New York, Westchester & Boston Railway

Month 1914	Kw.-hr. per Car Mile
April	4.61
May	4.35
June	4.38
July	4.34
August	4.33
September	4.33
October	4.42
November	4.91
December	5.63

Month 1915	Kw.-hr. per Car Mile
January	5.53
February	5.46
March	5.22
April	4.41
May	4.24
June	4.26
July	4.24
August	4.20
September	4.15

The cars to which these figures apply are 72 ft. long, and with their passenger load weigh about 65 tons. In consequence, the figure for 1915 represents an energy consumption of 64 watt-hours per ton mile, and if 10 per cent. is deducted for lights and yard switching the energy consumption becomes only 57.5 watt-hours per ton mile; an astonishingly low figure for the service involved. The average schedule speed for all trains, both express and local, is 26.4 m.p.h. with an average of 0.93 stop per mile.

Under the system that has been established the meter readings are made by the motormen at the end of each round trip and are turned in to the dispatcher on a report form. The inspector, or switchman, who takes the car at the end of the trip also reads the meter before and after the switching operation and turns in a separate report. The two reports serve as the basis for a check whenever that appears to be desirable and as evidence of the accuracy of the reports it is decidedly interesting to note that the total monthly consumption of single-phase power used by the road checks within about 20 kw.-hr. of that obtained by totalling the figures given by the reports of the motormen and inspectors. The monthly totals are of the order of 800,000 kw.-hr.

The Autobus Gaining in Popularity—Efficient Service Under Most Trying Conditions —Further Improvements in Design

The J. G. Brill Company have just delivered two auto omnibuses for use in Plymouth, Pa., over a short interurban line. The larger of these buses has a seating capacity of 22 persons and weighs under 7,000 pounds. The smaller bus accommodates 12 persons seated and weighs 4,700 pounds. The smaller of the two is shown herewith.

One of the most unusual features of these buses is the safety exit arrangement. Usually in this type of car the emergency door has been placed in the middle of the rear end, making it necessary to remove a seat before the door

12-Passenger Autobus.

could be opened. In these new buses the door has been placed on the right hand side of the bus to include the rear window and the space below it. The design and finish of the car is such that when the door is closed the side of the car presents an unbroken line, adding to the attractiveness of its general appearance. The real advantage of placing the door at this point, however, is that its location does not weaken the frame work of the bus, as it does not extend down through the guard rails.

The entrance is at the right-hand forward corner of the bus, where there are two stationary steps and a folding door with two leaves. The driver is seated on the left-hand side of the car, his seat being so placed that he can conveniently collect fares from the passengers entering. Across the rear of the bus there is a transverse seat which, in the larger model, will accommodate five persons. The larger bus is mounted on a 1½-ton chassis with a wheel-base of 157½ ins. and 36 in. wheels. Width over the side sills, including the sheathing, is 6 ft. 7 in.; width over posts at belt 6 ft. 10 ins.; width of aisle 15 ins.

The smaller bus is mounted on a chassis weighing only 2,852 pounds, having a wheel base of 133½ ins. with 34-in. wheels; width of aisle 15 ins.

The exhaust from the engine is used for heating in both cases. This effects an economy and makes for simplicity, since a separate installation for the generation of heat is unnecessary.

The Larger Aspects of Welfare Work—Public Critical and Unreasonable—Most Sincere Efforts on Part of Companies Often Fail of Results—Only Hope in Ultimate "Good Sense" of People

At the recent convention of electric railway men in San Francisco one of the most interesting addresses was that of Mr. J. W. Lilianthal, president of the United Railroads of San Francisco, on the subject "The Larger Aspects of Welfare Work. Apparently every reasonable attempt has been made by this company to meet their men and the public in an open, friendly and generous spirit. That they have failed to win their confidence or approval is one of the heart-breaking aspects of public utility work—not peculiar to this company. While the exercise of legal rights is counted an injustice, while local papers criticize to please their readers, and while adverse, though impartial, court decisions render the company and its officers subject to further personal dislikes and affronts it is little wonder that private organizations all over the continent are asking themselves whether, after all, they can ever dare to hope for anything better than an armed neutrality. In spite of all this, however, it is reassuring to have the president of this road go on record as confident "in the ultimate good sense and fairness of the people. Our salvation must be worked out through them, because after all, under our system of government, the power to deal with us rests with them, and we shall not win our battle until we make them feel that we are doing our duty by them. We must be polite enough to recognize our masters and public-spirited enough to be willing to make every effort to deserve the good-will of the people. The task will not be so difficult, if, as we should, we cultivate a frame of mind that makes this a labor of love."

Continuing, the speaker explained that he has laid down the following code of commandments covering his management:—

1. Accept loyally and without reservation the now universally proclaimed doctrine that a public utility is the servant of the people. The courts of last resort have so declared, and the public utilities have bowed their heads in meek submission. Whatever the resources or lack of resources of the utility, adequate service must be rendered. The requisite capital must somehow be provided, the matter of adequate return being irrelevant, except in the sense that the right exists to appeal to the rate-making bodies to provide for reasonable compensation for the service rendered. Do not wait until pressure is brought to compel adequate service. Anticipate the public demand. Keep your door wide open to every complaint. Forestall criticism by inviting recommendations, and in all close cases give the public the benefit of the doubt.

2. Give the affairs of the utility the widest publicity. The public is entitled to know what you are doing and how you are getting on. Conditions may be unfavorable, and you may fear that publicity might affect your credit, but you should not ask for credit that you do not deserve, and perhaps your misfortunes when frankly told may beget the public sympathy and good-will which you so sorely need. Nothing is so engaging as complete candor. When I have been interviewed by the reporter of a newspaper, however unfriendly, I have answered every question directly and fully. As a result it has happened to me at least once that when such candor has not changed the tone of the unfriendly newspaper the reporter has insisted that this attitude be changed or that someone else be assigned to his task. I have gone to men who have assailed me and sought to explain to them my reasons for doing the things that they have criticized. This has sometimes led to a change of front or, as in the case of at least one newspaper editor, to a statement that my position was justified, but that his newspaper to hold its circulation must continue to print the news to please patrons.

3. Treat your employees fairly and, as far as your resources will permit, generously. The man who is well fed and well clothed, who has a reasonable amount of time for play and recreation, who is in a position to save a little for a rainy day or toward the owning of his own home, who feels that his superiors are always ready to receive suggestions or to redress real or imaginary grievances, who is not exposed to nagging and hectoring by officious subaltern officers, who enjoys the right of appeal, who is made to feel that all the employees of the company, from the president down, are members of one family, each having the same paramount duty to serve the public and the employer—such a man will give the best results.

It might be well to have a council, composed of representatives of the men and the chief executive officers of the company, meet once a month to consider measures for the improvement of the service and the increase of efficiency. The representatives of the men should be selected for a certain period by secret ballot—say one from each carhouse. In that way the most popular man would be chosen and through him all the employees of that carhouse would feel that they had a mouthpiece. A new election should perhaps be held every six months or year. This plan will at least furnish a sort of safety valve without providing much of a nucleus, if any, for agitation or organization.

4. Keep out of politics. The public utility is the target for the politician. Those who are not venally dishonest have, at least in recent years, found that attacks made upon it are the short cut to popularity. Those who are venal have found the strike bill the most lucrative source of revenue, and it has seemed necessary to go into politics to keep such men out of office. Where the only purpose of the utility in so doing has been to eliminate such as these, the motive is, of course, ethically justifiable. But all know to what abuses this has led. The utility, to accomplish practical results, has had to build up a political machine. Having through this machine acquired the power to defeat injustice, to stifle bad bills and prevent biased judgments, it is tempted to use

this power for affirmative selfish ends and the temptation generally proves irresistible. Then the people, feeling themselves throttled are driven to rebel and are themselves led into excesses by the desire for revenge. It is from these excesses that we are now suffering.

5. The alternative remedy involves the next commandment—appeal to the public for fairness and justice. Deem it your right and duty to influence public opinion. Complain of the wrongs that are done to you. Expose the methods of corrupt or unfair politicians. Combat the arguments of muckrakers and pseudo-reformers. Circularize the public. Buy space in the newspapers. Participate in public discussions. Above all, however, remember that whenever you do anything along these lines you must do it openly and in the name of the company. Do not hide behind reading notices. Do not have paid agents masquerading as independent gladiators.

Electric Railways in Critical Financial Position —Narrow Margin of Profits Not Appreciated —Actual Situation Must Be Placed Before Both People and Governments

In a recent address on "Relation of Railways to Agriculture" by Mr. Paul Shoup, before the San Francisco Electric Railway Convention, the speaker emphasized the lack of knowledge of the general public as to the narrow margin of profit realized in the electric railway business. Speaking of California roads the following extracts are interesting and somewhat disconcerting:—

I have no fault to find with the public when it knows it is just and when it is appreciative of our difficulties. But the things we do right are not apt to be uppermost in its mind. The good service we give is accepted unconsciously as a matter of routine. It is up to us to tell effectively and truthfully our trials to the public. We must win its confidence and its interest, and to do so must go further than fair dealing. We must tell the people of our weakness, as well as of our strength. The public must learn that the electric railways are business institutions traveling upon the most narrow of business margins. Without the government's active support and sympathy they may in large measure disappear.

This is no alarmist statement. The time has passed to gloss over the facts. The electric railways of California have created hundreds of millions in property values, not only in the agricultural communities served but in cities and towns that they have helped to build. No community leans upon jitney service; none desires to lose a single car or train because of that service. They realize unconsciously that all the automobiles in California together transport but a small fraction of the number of people that are carried by the electric lines.

Before me are the earnings of nearly all the electric lines in California for the last three fiscal years. The showing is a bad one. Only one out of twenty-four made as good a showing during the fiscal year ending June 30, 1915, as for either of the two preceding years. Obligations to the public have increased; taxes are higher; paving costs, because of high standards, are greater; labor costs, where there have been changes, have increased; automobile traffic has required additional safety measures. On the other hand, automobile competition has cut revenues. Returns for the year are the worst in the history of the roads in this State, as a whole. No interurban line and but few city lines earned interest on their investments or on their interest-bearing obligations. One only of the twenty-four declared a dividend. Several are in the hands of their creditors. From such a showing, even after making allowance for general depression of business, which is widespread, it is plain that the public view must in some measure change if the electric railroads are to be maintained in their present efficiency.

Taxation must be lessened, not increased. Street paving burdens in many instances must be reduced or the lines abandoned. While adjustments in rates are individual questions, yet fares as a whole must be increased rather than lowered. Jitneys, dividing the traffic of the electric roads, must divide likewise their heavy obligations. Where the electric lines are providing and maintaining a large part of the street and where the community is under moral obligation to protect the investment made because of this and the investment needed to meet franchise requirements as to service and fares, the jitneys must, where practicable, be kept off such streets, and where, in the business centres, they use the streets, they must be required to bear some part of the paving burden. On very few streets or on very few interurban lines is there enough business to support two classes of carriers. Our returns show that. Of course, the jitneys assail our best earning lines, and the natural result of this is, no longer having fat lines to carry the lean ones, the service on the latter must be reduced or the lines given up. Only a small alienation is necessary to reduce income to the level of operating expenses. The public must know these facts, and knowing them must choose between. It is at this point we have arrived.

Big Company Establish Employees Savings Fund

To encourage the spirit of thrift among its employees the Westinghouse Electric & Mfg. Company has just established a savings fund which offers facilities to the employees for the handling of their savings accounts. This fund is open to any employee of the company wherever he may be located, and he may become a depositor at any time and discontinue at any time. The amount of the deposit cannot be less than 10c. and may be any multiple thereof, and the deposits must be made from each regular pay. The deposit, however, is limited to one account, the amount of which in any one year cannot exceed $500. The idea of this is that the plan is intended as a method of encouraging the employee to save his earnings and when he has been successful up to that point, allow him to handle his own finances. Interest is paid on the deposit at the rate of 4½ per cent. and is credited semi-annually.

An interesting feature of the fund is that the Westinghouse Company acts as a trustee and guarantees the deposits and interests. The rules provide that an amount of $100 or less may be withdrawn without notice, but an interval of two weeks must elapse before subsequent withdrawals can be made; for withdrawals more than $100, notice of one week must be given.

An auditing committee not to exceed 7 persons is to be elected by the depositors from among their own number, which committee shall be given an opportunity to examine the condition of accounts at semi-annual interest period, the findings of which shall be published.

Program for C. S. C. E.

Among the papers promised for the winter session of the Canadian Society of Civil Engineers, to be read in Montreal are the following: On the Cedars Rapids Power Plant, by Mr. Henry Holgate, consulting engineer, Mr. R. M. Wilson of the Montreal Light, Heat and Power Company and Mr. J. C. Smith of the Shawinigan Water and Power Company; on the Mount Royal Tunnel, by Messrs. S. P. Brown, A. Stewart and W. C. Lancaster; on Street Railway Electrolysis, by R. H. Parsons, late power superintendent of the city of Edmonton; and on Street Railway Construction, by Mr. H. J. Tippett, engineer of maintenance-of-way, B.C.E.R. Company.

The Dealer and Contractor

Wiring *my* house "without profits" means doing it at *your* expense—Hydro-Commission of Ontario inaugurating a pernicious system which calls for united action by Ontario Electrical Contractors

Has the electrical industry reached such a low ebb in Ontario that our Hydro Commission has been driven to adopt such truly remarkable measures as outlined in the accompanying advertisement, which recently appeared in a Simcoe (Norfolk County, Ontario) local paper?

Wiring **my** house without profit means, properly interpreted, wiring my house at **somebody** else's expense. Yet, this is apparently the proposition in Simcoe town. "Wiring without profits," as expressed to a representative of the Electrical News by Mr. Crapper himself, means "material and time" only. In the town of Simcoe, then, if a citizen gets his house wired his fellow-townsmen come forward and bear all expenses outside of "material and time." We all recognize that this is a time when philanthropy seems to be in the air, so generously is it practiced by Canadian citizens, but it can easily be appreciated that this is a form of it not relished by the average taxpayer of Simcoe.

On investigation the statement in the advertisement "we would like to use Hydro but wiring costs too much" appears to be absolutely untrue, from evidence gathered on the ground by our representative. On the face of it, too, it is quite unreasonable. Simcoe town boasts of five firms doing electrical contracting work, where one, or two at the most, would be ample. With competition on this scale the chances of wiring costing too much are pretty slim. Evidently one must look elsewhere for the real reason of this remarkable move—doubtless to the keen competition of low-price natural gas and the comparatively high rates it is necessary to charge for electricity in Simcoe.

So, the general tax-payer in Simcoe is made the "goat" so that the wiring of a few can be done "without profits." Incidentally, the electrical contracting business is to be quietly and ruthlessly crushed out of existence and their stock-in-trade, good will and other incidental capital assets

ANNOUNCING THE NEW HYDRO PLAN OF WIRING YOUR HOME WITHOUT PROFIT

ON THE MONTHLY INSTALMENT PLAN

Many prospective customers have said, "We would like to use Hydro but the wiring costs too much." This statement, repeated so often, caused us to investigate the cost of wiring. We found that in many instances wiring prices were too high, so we devised a plan which insures your wiring being done without profit, and spreads the payment over a number of months.

We know the proper methods of wiring for Hydro service, and guarantee all work to be first-class in every particular, complying with every requirement of the Hydro Inspection Department at Toronto.

Hydro wiring—unlike gas fitting—can be done without inconvenience to your home or family. We take particular pains to leave your home in perfect condition, without marring walls or floors in any way.

SPECIAL HYDRO PRICES

We have only ONE PRICE to all, a fixed definite amount for each size house as follows:

WIRING PRICES on concealed knob and tube work in old buildings.

Size of House		Cost Complete
3 Rooms	4 light outlets	$12.75
3 Rooms	4 light outlets 1 snap switch outlet	14.30
3 Rooms	4 light outlets 2 snap switch outlets	15.90
4 Rooms	5 light outlets	14.30
4 Rooms	5 light outlets 2 snap switch outlets	17.50
5 Rooms	6 light outlets	15.35
5 Rooms	6 light outlets 2 snap switch outlets	19.25
5 Rooms	6 light outlets 2 snap switch outlets 1 flush switch outlets	21.35
6 Rooms	7 light outlets 2 snap switch outlets	21.25
6 Rooms	7 light outlets 1 snap switch outlet 2 flush switch outlets	23.75
6 Rooms	7 light outlets 2 snap switch outlets 2 flush switch outlets	25.45
7 Rooms	8 light outlets 1 snap switch outlet 2 flush switch outlets	27.50
7 Rooms	9 light outlets 2 snap switch outlets 2 flush switch outlets	30.75
7 Rooms	10 light outlets 2 snap switch outlets 2 flush switch outlets	32.50
8 Rooms	10 light outlets 2 snap switch outlets 2 flush switch outlets	33.00

Standard Price on all additional lights and switches.

A charge of two dollars and ten cents ($2.10) will be made for each extra flush switch or flush receptacle outlet, and one dollar and eighty-five cents for each extra snap switch or light outlet.

WIRING PRICES on open knob and tube work in old buildings.

3 outlets cost complete eight dollars and fifty cents ($8.50). For all outlets over 3 and under 11 a charge of one dollar and sixty cents each will be made. 11 outlets cost complete twenty-one dollars, ($21). For all outlets over 11 and under 21 a charge of one dollar and sixty cents each will be made.

Outlets are all wired to average not more than 60 watts to the outlet.

We will supply at above prices, drop cords, and any size lamp up to 60 watts hung ready to light.

NOTE. Above prices include switches, drop cords, sockets, lamps, and service box, no extras, everything ready to light.

Prices on conduit and metal moulding work will be furnished on request.

TERMS OF PAYMENT 25 per cent. when work is completed; balance in 12 monthly instalments, paid with the meter bill. 5 per cent. discount for cash.

THE SIMCOE HYDRO-ELECTRIC SYSTEM
R. H. CRAPPER, Phone 167.
Hydro Office - 56 Peel Street

can be written off as bad debts or, more correctly, "hydro" debts.

To say the least, it is a humiliating position for the electrical business and for the men who have been proud to be engaged in the electrical business, to find themselves in.

And this is not all. Mr. Crapper, the same man who signs the advertisement, is himself the wiring inspector of the town—the appointee of the Hydro Commission of Ontario—a dual position, placing upon the inspector, as such, the responsibility of inspecting his own work, as a contractor doing work at cost, and the work of his competitor, trying to make a fair profit. Without the slightest reflection on this inspector's honesty it is not going too far to say that the situation contains possibilities and temptations of such a varied nature that the Commission is not justified in asking any man to accept it.

It is, of course, always easy to criticize but anything we have said is only with the desire to point out what appears to us as a tactical error of the Hydro Commission of Ontario in inaugurating such a plan as that outlined in the Simcoe advertisement. Our Hydro Commission has plainly got its hands full enough now without going out of its way to bother about such matters as house wiring, especially where the organization and machinery for carrying on this work are already in good working order in the various electrical contracting firms distributed throughout our towns and cities. What is to prevent the Commission from cooperating with these existing firms?

We venture the suggestion that the most reasonable solution of the Simcoe matter, and all similar cases that may arise, is a workable arrangement between the local commission and the local contractors by which it is agreed that certain standard work is to be completed at a certain fixed price—material, plus time, plus a reasonable overhead and profit. This will insure the work being done in such a way that the householder gets full "value" for his investment—and no self-respecting householder expects, or will think of asking, more. This system is being worked out with admirable results in many towns and cities on this continent. It is a system founded on justice and sound business principles.

We trust the Commission will lose no time in remedying the evils already wrought by this "experiment," in the town of Simcoe. The solution is ready to hand—co-operation with the electrical contractors that the work may be honestly done at an honest price. Only when the contractors refuse to co-operate would the Commission be justified in entering the field of electrical contracting and then only on a fair basis of competitive prices and under strictly impartial inspection.

Estimating Costs and Keeping Accounts

By Mr. J. P. Coghlin

The object of this paper is to put before you a few ideas so as to help bring about more uniform conditions in the electrical contracting business.

Why is there such a great difference in bids made by Electrical Contractors? I believe this is generally due to three reasons and believe that the most important one of these is the fact that contractors in making bids do not know how to figure and invariably guess at quantities and labor. This brings the bid generally either away high or low and if the bid is low, the contract is taken at a loss or too low a profit while rarely ever does this type of contractor get a job other than the low bid. As it is practically impossible to guess right as there are too many guesses, therefore, a large amount of electrical work is done at a loss with the result that the field for contract work at a legitimate profit is limited that much.

The second reason, and this often happens a great many times with all of us, is, that the contractor forgets or leaves out something in his estimate. It is no uncommon thing for an estimator to forget to figure in mains, figure in wire for conduit, or to leave out cutout cabinets or some other important item and I am sure that every contractor right here in this room will agree with me that he has done this many a time.

The third reason is "The gambling trait in a contractor who wants to take a chance." He reasons this way: The last job he figured was 20 or 25 per cent. high and A got it. The contractor does not know how he did it, whether it was by trimming the job, or by working up a lot of extras, or at a loss, but anyway, many contractors feel that if somebody else can do a job below cost there is no reason why they will not be as successful, and they generally are as successful, and eventually find they are playing a losing game, with the cards stacked.

Taking a chance on a contract is not business and while we may be successful now and then and get by, we will not pay dividends if all our contracts are taken on this basis.

The question is "How are we to figure costs and estimate correctly." Large and successful contractors are large and successful because they know how to figure cost and you will find that they do not bother with the smaller jobs, because the smaller and less experienced contractor invariably takes these jobs by guessing, at a loss, or a profit which is not large enough to carry on his business. The way to learn how to figure contracts is as follows:—

In order not to forget material going into an estimate, it is necessary to have an estimate sheet ruled and printed for the kind of business you are doing. For example: Have one sheet printed for knob and tube work; another sheet for conduit work; and another sheet for factory work, etc. Have printed on each one of these sheets the material that usually goes into this kind of work. By having these items printed there, it will jog your memory in making up your estimate and you will not be so likely to overlook material required.

In having this sheet printed, have two columns in this sheet, one for totals of quantities estimated and one for totals of quantities used. When you get a job, keep absolute track of every particle of material which goes onto the job and check back all material which comes back from the job and is fit to be put back in stock. It is well also to keep track of scrap material which has some value, such as copper wire, etc. When you get the totals of material used, put these totals in the column of quantities used, this being next to your estimate column, you have then an opportunity of comparing item by item and if you study these over from job to job, in a very short while you will begin to see where you made errors in your estimates and you will find that your two columns will begin to be alike. By analyzing this also, you will be able to find that some of your workmen use less material than others on similar jobs and by studying the nature of the work on these estimate sheets, you will

also find that different conditions arise which make material vary more or less on individual jobs.

This is something that it is necessary to study continually. On large jobs you will find it of advantage to total up your material used every week or month, as the case may be, and by doing this it will give you a chance to find out whether your workmen are carrying on the job economically or not, and you will find that just as soon as you start this system, that your workmen are going to be more careful and will save material and labor when they know that their work is being followed in the office. This opens an opportunity for you to work out a workman's compensation for your men if you are interested in increasing the efficiency of your labor. By following this system you will find out whether too much material was used or not used on the job. By this system, our firm found on one job that a workman had charged up to the job some eight thousand feet of No. 14 rubber covered wire which was found later in his room. It was discovered on checking up the job that a great deal more No. 14 rubber covered wire was used than was estimated, and by sending out our superintendent to check up the amount of wire installed and wire on the job and reporting back, it was discovered that there was a big discrepancy. We called in the workman in charge and explained to him that we could not check up the wire, and he finally admitted that he had eight thousand feet of wire in his room, which, by the way was in a neighboring town sixteen miles from the job. We got the wire back and were able in this way to save ourselves the cost of this material and also find out the character of the workman. This is an easy and simple way of handling the question of estimating material, but the question of estimating labor is a more difficult one.

Figure Labor by Unit System

I want to repeat here an old statement which I have heard a great many times of "How Contractors oftentimes estimate Labor." After you have spent several years scaling plans and estimating material, which amounts to generally 50 per cent. of the job, you will figure out the labor which amounts to the balance or 50 per cent. in about fifteen minutes. You will say to your partner or superintendent, I believe that Bill or George can do this work in about twenty-five days, and your partner or superintendent after studying the ceiling or looking out of the window for a few minutes to get an inspiration will say, "Gee if we want to get this job we cannot figure that much time. B just did a contract like this and we were too high, if we want to get this job we have got to cut the labor down." And so you compromise on about twenty days and this 50 per cent. of the job is settled in about fifteen minutes, generally after spending all evening estimating material which is only 50 per cent. of the job. When you get through with the job and figure your cost you will invariably find that you are away low on labor. In our experience in checking up the costs of contracts, we find that on new house work labor will run from 40 to 50 per cent., on old house work from 50 to 65 per cent., on iron conduit work, fire proof construction from 35 to 55 per cent., on iron conduit wooden construction from 50 to 75 per cent., so that you will see the labor is about half of the cost of the contract. The only way to figure labor is by the unit system; find out what the cost for labor for wire per foot is to put up; on knob and tubes; running wire on cleat work; pulling wire into conduit; what it costs per foot to run conduit on different kinds of construction; what it costs to set a switch box; what it costs to set up and connect cutout cabinets, per circuit, etc., down the line. Having determined this, all it is necessary for you to do is to take your quantities on such material as is effected by labor and extend these prices at the unit figure and you will have your total labor in dollars and cents.

Then the question comes, "How will you go about finding out the cost of labor for installing this material." The only way to do this is to have your workmen report each day, and I want to call particular attention to the fact that time slips should be put in every day no matter whether the man is working in town or out of town and should be o.k'd by the foreman on the job, because they will be more nearly correct if made out every day than made out at the end of the week. We insist on these being turned in every day if in town, and mailed every night if out of town. Have your workman indicate on his time slip, kind of work he was doing, number of hours it took him to do this work and the quantity of material he installed during these hours and the nature of the conditions under which this work was done. By taking a series of these and averaging the same you will get your unit cost of labor. This will vary on different jobs and will vary with different workmen, and here again you will have a chance of checking labor same as material.

Just as Necessary for the Little Fellow

You will say this all very nice if one is doing a large business and has lots of money to spend on red tape, etc., and that large firms can afford to do it. Now let me tell you, no firm, no matter how large or small its business is, can afford to do without this and as I said above, the success of the big concern is due to the fact that it has worked out some similar system; but no business, whether electrical or otherwise can continue to be successful, unless it knows the cost, and figures in its overhead expenses and, in addition, a suitable profit, and if you will spend half as much time studying cost sheets as you do in knocking your competitor, because he got a job away from you, and saying how much money he is going to lose, etc., you will find your returns at the end of the year much more satisfactory.

Andrew Carnegie claims that his success in business was due entirely to his system of costs and has made the statement that when he was in business, that if his entire plant was destroyed, but his system was saved, he could reorganize and go on with his business. By his cost system he was able to determine what lines of products he could make the profit on while his competitors without a cost system were figuring in the dark, so that Carnegie figured a little higher on material where the profit was small and a litte lower where the profit was large with the result that his competitors were loaded up with unprofitable business and he took the cream.

Let Unprofitable Work Go

Electrical contractors will find if they know their cost that there are certain lines of work which they will be able to take at a good profit and should keep after this line of work and let competitors who are unable to discriminate have the other, because if you work out this cost system correctly on different lines of work, you will be surprised to find that on some lines of contracting you are making a larger per cent. than you figured, while in other lines you are making a much smaller per cent., sometimes doing certain work at a loss.

I have here some estimate sheets which we use in our business and which I would be very glad to let anybody have, and also to answer later on, any questions which may come up in connection with these, or other forms which I will take up later. I am sorry not to have a form of our time slips here, which we have our workmen turn in. We are drawing up a new one at present, as the old one which we had was not satisfactory and just as soon as we get these out we will be glad to furnish a sample to anyone who is interested. Make your time slips large so a man can write out the whole story. Paper does not cost much.

In carrying out this system it will not require a great deal of additional clerical force in the office. I should say

that the average electrical contractor could have this work extended and totaled up by the addition of only one girl in the office at about $8.00 a week, as it is not necessary to have an expert bookkeeper but just simply a girl that is accurate at figures, and if you stop to think about it, there are many jobs you lose more than $8.00 a week on, and you will find at the end of the year that this expenditure for bookkeeping will save you many more dollars than the salary of the additional help. And you will also be surprised to find out that you are making more money and that you are beginning to be a bigger man, that you are having more time to give to other things and that your business is growing faster than it ever did before.

The only way to determine overhead expenses is to keep an absolute account of every expenditure in connection with the business, no matter how small or large the business may be. A contractor employing one or two men and working with his men and having no office, has, at the same time a large overhead expense, and he will find that if he keeps account of this, that it will generally amount to 30 or 40 per cent. of his gross business. In the first place he must charge up to the business a reasonable amount for wages for himself, at least as much as he would get by working for another. If he carries a stock of goods, the interest on the money invested in this is a part of the overhead expenses, insurance, telephone, advertising, if any, and although you may not use newspaper advertising, you will find

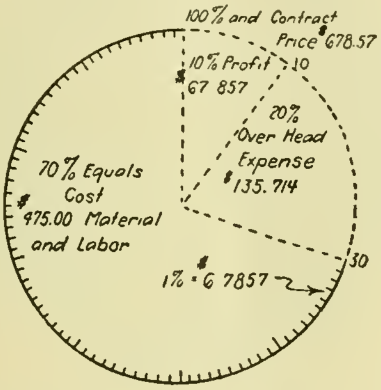


Diagram to illustrate problem in overhead.

that you are buying tickets for entertainments, contributing to and joining societies, clubs, etc., in order to be a good fellow and get business. You are buying somebody a dinner, cigar, ticket for the show or ball game, a drink, etc. All these items should come under the head of advertising.

Strict account should be kept of all small purchases, which you will find at the end of the year, amount to quite a sum. Giving the workmen 10 or 15 cents to buy gasoline, solder, or some similar item on the job, carfares, etc., will aggregate a large amount in the year. If you have an automobile, or a team, all expenses in connection with this should be charged up to the business. The only way for any contractor, whether large or small, to handle this matter, is to see to it that everything is charged and then have the bookkeeper separate the charges, putting the amounts which are non-productive into one account, (and by non-productive I mean, anything that cannot actually be charged up directly to the job, whether contract or stock and labor,) and charging the other items to the respective jobs.

Another way to go at this is, to take the difference between the total of all charges at full cost to the job for a month or a year and subtract this from the total expenditures, to which should be added non-productive labor, that is, labor that cannot actually be charged to any job. In addition to this, you will have lots of things such as bad bills, cost of collecting, broken, lost or stolen stock, etc.; all of these must be added. This total will give you your overhead expenses.

A Problem in Overhead Expense

The cost of material and labor on a job is $475.

The overhead expense is 20 per cent. and 10 per cent. profit is desired.

What should the contract price be?

The circle represents 100 per cent. and the contract price. The dotted section of the circle represents 30 per cent. (profit 10 per cent., overhead expense 20 per cent.); the balance of the circle, 70 per cent., equals the cost, $475.

We must first find the contract price before we can figure the profit and overhead expense.

If 70 per cent. (section of circle divided into 70 parts) equals $475, 1 per cent. (1 part) will equal $475 divided by 70, which is $6.7857. And if 1 per cent. (1 part) equals $6.7857, 100 per cent. (100 parts), the whole circle, will equal 100 times $6.7857, which is $678.57, the contract price.

We can now find the amount of profit and overhead expense.

Profit	10%	of $678.57=$ 67.857
Overhead	20%	of $678.57=$135.714
Cost	70%	of $678.57=$ 475.00
	100%	$678.571

It was necessary to add over 42 per cent. to the cost, $475 (material and labor), to make this contract price $678.571.

You will see from the above that if your overhead expenses are figured on the percentage of your gross business that it will not do to add this percentage to your cost, as it is always a larger percentage on cost. Take a pencil and paper and figure this out for yourself and you will be surprised if you have not already discovered this, to find what a difference there is an how you have been fooling yourself by adding a percentage to your cost in order to cover your overhead expense and profit.

Electric Furnaces in the Steel Industry

(Concluded from page 28)

Sherbrooke had been developed by Mr. McCullough, and practically the entire equipment had been made by the company.

Mr. G. C. Mackenzie, chief of the division of ore dressing and metallurgy of the Department of Mines, Ottawa, a member of the Government commission investigating the iron ore resources of the Dominion, described visits to Welland and Toronto, and the operation of electric furnaces there. At the former place the Electric Steel and Metals Co., were engaged in making steel for shells by means of electric furnaces, while the Union Carbide Co. of Canada had a 15,000 h.p. furnace for making calcium carbide. In Toronto the Moffatt-Irving process for the production of steel in an electric furnace direct from Canadian ore was being attempted and the Government was about to test this method.

Mr. Evans of Belleville briefly referred to the Evans-Stansfield process for making tool steel electrically from Titaniferous ores.

Mr. C. Bristol of the Armstrong Whitworth Co. spoke of the manufacture of high speed tool steel at their works.

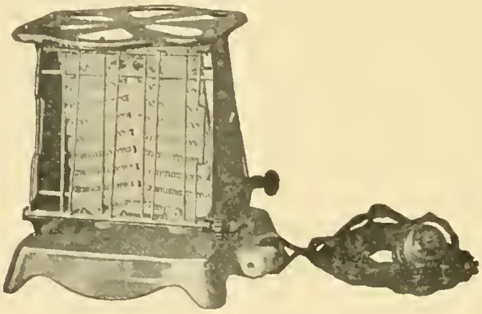
At the termination of the speeches, an adjournment was made to the Metallurgical Laboratory adjoining, where two electric steel-making furnaces were shown in operation.

A new electric generating plant has been placed in operation in Waskada, Man., and the citizens are now enjoying an efficient house and street lighting system.

What is New in Electrical Equipment

A Toaster that Turns the Toast

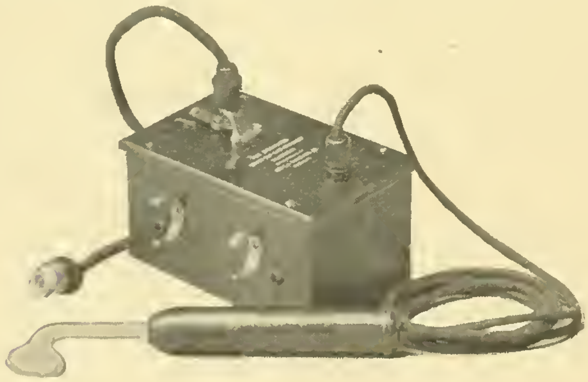
A recent addition to the line marketed by the Westinghouse Electric & Mfg. Company is the "Turnover Toaster." The appearance of this device is shown in the accompanying illustration. By turning the knob near the bottom the frame is thrown outward, while wire catches at the bottom trip the toast outward so that it slides along the frame, browned side down. On turning the knob back again the toast is



raised to a vertical position with the fresh side toward the heater. The heating consists of a continuous coil of resistance wire wound on a porcelain plate. The resistance is so distributed as to produce uniform heating, taking into account the variation in heating effect caused by the vertical position of the heater. The entire device is nickel-plated and highly polished, and has a shelf for warming plates or keeping the toast or the coffee hot.

Manufacturing in Canada

The Chas. A. Branston Co., 359 Yonge St., Toronto, have just recently commenced the manufacture of electro-medical appliances. This company are the first to manufacture electrical goods of this kind in Canada, which have heretofore been imported. The accompanying illustrations show one of their models of high frequency violet-ray generators. These generators are highly endorsed by physicians and many are being sold to hospitals, sanitariums, medical men, dentists,



osteopaths, barbers, and in private homes. The primary action of the appliance is to stimulate the circulation. It does this far more quickly and the results are claimed to be more permanent than with any other method. Besides increasing the circulation the ozone generated by the action of the thousands of minute electric sparks passing through the air, is driven deep into the tissues thus increasing the quantity of oxygen in the blood. A special ozone generator attachment is also furnished whereby ozone is generated in larger quantities for inhalation purposes; this is highly recommended for nasal, throat, bronchial and lung affections. Violet rays are also destructive in their effects on all germ life and are capable of thoroughly disinfecting impure water. It is being used extensively for purifying the water at the different camps throughout the war zone. It is also used with splendid results in the treatment of skin diseases.

New Nitro Fixtures

To meet the increasing demand for practical, original and well ventilated fixtures for nitrogen lamps, both for indoor and outside service, the Premier Electric Co. Ltd., of 74 Victoria Square, Montreal, are marketing two sizes of out-

door and one indoor fixture, the former in cast iron (large size as cut) the latter in brushed brass. The large cast iron fixture represents a type of which a considerable number was recently supplied for dock service in Canada.

Unaffected by Oils

Spielmann Agencies, Read Building, Montreal, are drawing special attention to another of their Griffiths Bros. products, namely, Driorol, which they claim is one of the most generally useful enamels ever introduced in engineering work. This is an oil-proof composition, drying quickly over greasy or oily surfaces and being unaffected by lubricating oils. The standard color is black and owing to the nature of the materials employed in its composition only a limited range of colors is possible. It is, however, obtainable in dark or light grey, blue, brown, buff, purple, green, dark red and signal red.

In Record Time

The Secretary of the Electrical Dealers' and Contractors' Association of Ontario is to be congratulated on his very prompt report on the proceedings of the first annual convention of this association, which has just been distributed. The dispatch with which Mr. Earle has handled this work augurs well for the future of the association as a wide-awake organization.

Soft-toned Gong

The cut herewith illustrates a new type cathedral gong now being sold by the Norton Telephone Company. This gong is so designed as to give the volume of a loud sound-

ing bell but at the same time it eliminates the disturbing elements usual with most loud-sounding gongs. The tone is said to resemble that of a soft-toned hall clock.

Regulating Socket

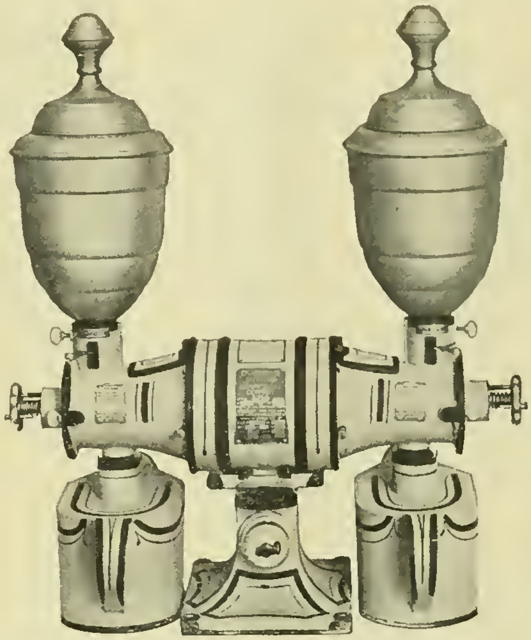
There has recently been placed on the market a practical, efficient and compact regulating socket which solves the problem of turning an electric lamp "up and down." The Wirt Dimming Socket, shown herewith, combines all the best features of the standard Pull Chain Socket, Shadeholder and Dim-a-lite. It is designed to be permanently attached to the fixture stem with thread and set screw. The lamp, which is controlled by the pull chain, may be turned up or down, giving five changes of light—full, half, dim, nite-lite and out. There is a saving of from 30 to 80 per cent. current at the meter, depending upon the degree of turn-down. These sockets have already met with the most complete ap-

proval of architects, engineers and the electrical trade generally. They are valuable on house fixtures, in hotels and hospitals. These new sockets are being sold in Canada by the Benjamin Electric Mfg. Co., Toronto, who act as agents for all Wirt Co., devices.

The A. A. Electric Manufacturing Company have registered in Quebec, headquarters Montreal.

Every Grocer Needs One

The coffee mill illustrated is capable of granulating from one to two pounds and of pulverizing from $\frac{1}{4}$ to $\frac{1}{2}$ pound of coffee per minute, depending upon the condition of the coffee. The capacity of each hopper is about three pounds. The mechanism of the mill is very simple, there being no complicated parts to get out of order. The mill, the hoppers and the receiving cans are all enclosed preventing dirt from accumulating inside. The mill is furnished with a motor of



such capacity as permits of coffee being granulated and pulverized both at the same time. The motor to which the coffee mill is direct connected is a 1/6 h.p. repulsion induction type, single phase, manufactured by the Century Electric Company, St. Louis, Mo. The motor starting under full load accelerates so quickly and requires so little starting current that it can be connected to the lighting circuit without affecting the lighting service.

Crawford Cedar Co.

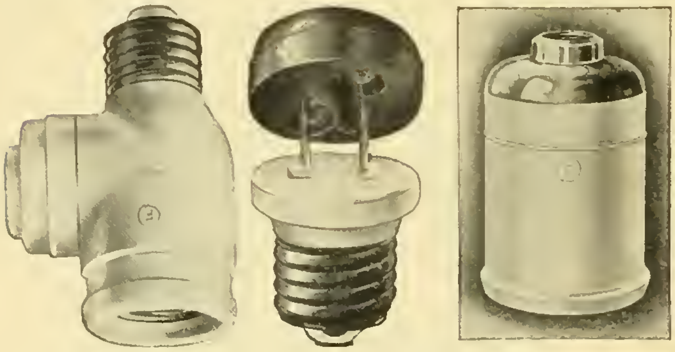
The illustration herewith represents a panoramic picture recently taken of the large concentration yard of the Crawford Cedar Co. at Menominee, Mich. This picture shows

about two-thirds of the yard which contains in pile approximately one hundred and twenty-five thousand poles, 18 ft. and longer, and approximately one million pieces of posts, 7 ft. and up to and including the 16-ft. lengths, as well as about one hundred and twenty-five thousand cedar and hemlock ties. In the back ground can be seen a volume of material in raft in the Green Bay waters which is being taken out and distributed into the respective piles by machinery—that is, two traveling derricks, an elevator scow hoist and

endless chain tramways back of the mill. This company are carrying a considerable volume of stock at operating points and landings along the C. & N. W., C. M. & St. P., Wisconsin & Michigan, Soo Line and South Shore railroads.

New Electric Supplies

The cuts herewith illustrate some of the equipment now being manufactured in Toronto by the Electric Specialty



and Supply Co., 20 Adelaide Street West. Fig. 1—current tap; Fig. 2—separable attachment plug; Fig. 3—keyless porcelain Mogul socket.

Jovian Doings

Mr. Geo. C. Rough of the Packard Electric Company of Canada has just returned from attending the 13th annual Jovian Congress held this year at the Hotel Sherman, Chicago, October 13-14-15. We understand Mr. Rough received the nomination as Jupiter of the 14th Congress but withdrew in favor of Mr. Thos. A. Wynne, vice-president and general manager of the Indianapolis Light and Heat Company, who was subsequently elected. Other prominent Canadians in attendance at the 13th congress included Mr. J. F. Ward, Northern Electric, Toronto, who is Congressman for the 14th district, and Mr. Frank E. Filer, Packard Electric Company, Winnipeg, Congressman for the 15th district.

Trade Publications

Oil Switches—Bulletin No. 47406 by the Canadian General Electric Company, describing, with illustrations, type "F" "K-20" oil switches up to 2500 volts.

The Oscillograph—bulletin No. 46111, by the Canadian General Electric Company, describing their electromagnet type oscillograph; well illustrated.

Electrical Supplies—catalogue No. 15, by the Canadian General Electric Company. This is one of the most complete catalogues ever put out by an electrical manufacturing or jobbing house and contains 1100 pages of very thoroughly illustrated information.

Trade Enquiries

1127. **Electrical materials and machinery.**—An agent at Rome would buy for own account or sell on commission with del credere, electrical materials and machinery. Represented Berlin firm for fourteen years. R.D.P.

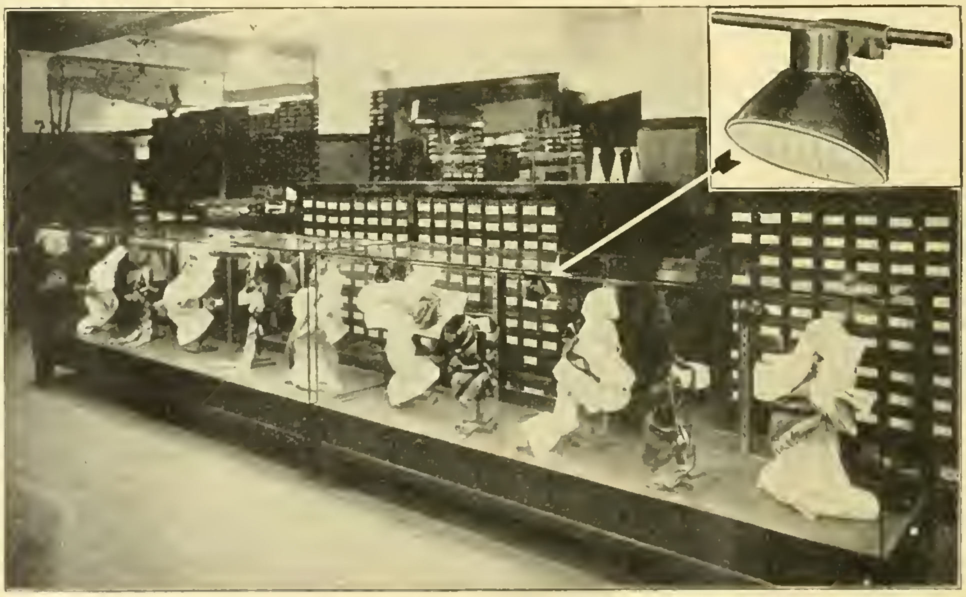
The Canadian Sales Co., Toronto, factory representatives, announce their change of address from 166 Bay Street to 165 Church Street.

The Hughes Electric Heating Co., Chicago, Ill., have been awarded a Gold Medal for Electric Ranges and Ovens at the Panama-Pacific International Exposition, San Francisco.

The Fargo Manufacturing Company, Inc., of Poughkeepsie, N. Y., have opened general offices at 52 Vanderbilt Avenue, New York City. The factory will still remain at Poughkeepsie.

The Renfrew Electric Manufacturing Co. Ltd., of Renfrew, Ont., are making an addition to their already large plant, which will increase their assembling area and provide additional space for plateing room and storage.

The Volt Electric Company, Toronto, are distributing their electric catalogue No. 14 which shows in abridged form staple and standard goods such as are in most general demand and which are carried constantly in stock by this company; the catalogue is well illustrated.



Correct illumination of showcase by "Scoopette" reflectors—Gents furnishing store.

Current News and Notes

Brandon, Man.

Negotiations between the city council and the Brandon Electric Light Company are held up pending the re-organization of the Public Utilities Commission of Manitoba due to the recent resignation of Commissioner Robson.

Barrie, Ont.

The Toronto, Barrie and Orillia Electric Railway have made a request that their franchise be extended one year.

Edmonton, Alta.

There has been a change in the situation in Edmonton with reference to the decision of the council to accept the proposal of the Edmonton Hydro-electric Power Company (represented by G. W. Farrell & Co., Montreal), to develop hydro-electric power on the North Saskatchewan River at a cost of about six million dollars and to supply current to the city. The offer includes taking over the present city power plant and delivering power at 1.3c. per kilowatt hour, with a guaranteed minimum, the franchise to run for 30 years. Mr. J. E. F. Bown, K.C., the city solicitor, has expressed the opinion that the city has no legal right to enter into any agreement by which it changes its character from a manufacturer and distributor of power to a distributor only. It will therefore be necessary for the city to secure from the legislature the requisite powers if they desire to make a contract with any company. A competitive scheme was also submitted to the Council by the Wabamun Power and Coal Company, for which Walter J. Francis & Co., Montreal, are consulting engineers. Under this plan a steam plant would be constructed about 40 miles from Edmonton, current being offered at 1c. per kw. hour. Both companies claim considerable saving to the city as compared with the present cost, and in addition each company claims advantages for its own scheme in the matter of cost to the city over a series of years.

Guelph, Ont.

Work has been commenced on the installation of the equipment in the new building of the Bell Telephone Company on Cork Street, Guelph.

Gravenhurst, Ont.

The ratepayers recently carried a by-law authorizing the council to dispose of the South Falls plant to the Hydro-electric Power Commission of Ontario and arrange for a supply of power with the Commission.

Halifax, N. S.

At a recent meeting of the city council a committee was appointed to confer with the Halifax Power Company with a view to obtaining a controlling interest in the company's property.

Hornings Mills, Ont.

The Pine River Light and Power Company has been taken over by the Hydro-electric Power Commission of Ontario. This plant was owned by Mr. J. M. Kilbourn, of Owen Sound.

Kirkland Lake, Ont.

Work is proceeding satisfactorily at the hydro-electric power plant of the Tough-Oakes Mining Company on Blanche River.

Montreal, Que.

The City of Montreal have inaugurated the new civic lighting system on a part of St. Catherine Street and on Bleury Street. The lights are of the 6.6 luminous arc inverted type, on ornamental poles of special design, spaced 125 feet apart, with two lamps at important street corners or transfer points. The 186 lights replace 81 of the old arc type, suspended overhead. The contract for furnishing and installing the standards was carried out by G. M. Gest, Limited; the Eugene F. Phillips Electrical Works, Limited, supplied the cable and wiring, pot heads, lightning arresters, etc.; and the Canadian General Electric Company the lamps. In connection with the removal of the poles on St. Catherine and Bleury Streets, the Council have decided to pay $23,975 as an indemnity to the Montreal Tramways Company.

A civic by-law is being prepared compelling consumers to make connection with the Montreal underground conduit system. Hitherto this by-law has only applied to one street, but the experience of the Electrical Commission shows that a general law is necessary.

Port Colborne, Ont.

By-laws were recently carried in Port Colborne and Humberstone authorizing a five year's contract for the supply of power by the Ontario Power Company, Niagara Falls.

Quebec, Que.

Messrs. Goulet and Belanger, electrical contractors and supplies, Quebec, have moved into new quarters at 239 St. Joseph Street, one of the finest commercial buildings in the city.

Reston, Man.

A contract has been awarded by the Reston town council to the Accumulator Lighting Co., Ltd., of Winnipeg, for the installation of a generating and distribution system for lighting the streets and homes of Reston. The installation will be similar to the well-known system installed by this company in other western towns, with a storage battery for use during off-peak hours. Nitrogen tungstens will be used on the streets.

Ridgetown, Ont.

The town council are discussing the advisability of installing an ornamental street lighting system on Main Street.

Sandwich, Ont.

Hydro-electric power was turned on in Sandwich on October 14th and the street lighting service originally given by the Sandwich, Windsor & Amherstburg Railway Company has been discontinued.

St. Johns, Que.

Tenders are to be called for the lighting of the Richelieu Bridge between Iberville and St. Johns, Que. Thirty-six standards are required, three lamps to each and are to be placed eighty feet apart on both sides of the bridge. At both approaches to the bridge there will be two iron standards, each with five lamps.

St. Catharines, Ont.

The Bell Telephone Company moved over to their new building on October 18th, the cut-over being made in less than two minutes without a single complaint of delay in service being registered.

Vancouver, B. C.

The Couteau Power Company, who have plans for a hydro electric development on Shuswap River, have been granted an extension of time before which construction work must be commenced to August 28th, 1916.

Warwick, Que.

The town council are negotiating with the Arthabasca Water and Power Company with a view to obtaining a supply of electric energy for lighting the town.

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Generation, Transmission and Application of Electricity

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ADVERTISEMENTS

Orders for advertising should reach the office of publication not later than the 5th and 20th of the month. Changes in advertisements will be made whenever desired, without cost to the advertiser.

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The Hydro Strike

A large percentage of Toronto Hydro employees recently went on strike—chiefly for higher wages and more holidays.

If the striking employees expect the sympathy of the public at the present time they are doomed to disappointment. The public are just now interested in other things. Most of them are busy making both ends meet, trying to save up a little to meet tag day demands, and for the most part thankful if they have a job. We judge the Hydro strikers will get about the same consideration that the Welsh coal miners did on a recent similar occasion. In other words, the generally expressed opinion is that a strike at the present time is ill-advised.

There can be no claim made by the men that they are working under any greater hardships than formerly—working conditions are at least as favorable and the pay is at least as good as before the war broke out—which is true of comparatively few other workers in Toronto. It follows that one section of our citizens, already in a fortunate position, is being further benefitted at the expense of other citizen classes already less fortunate. It is true the Commission are disregarding the award of the board of arbitrators, and this perhaps is unfortunate. The present times are abnormal, however, and precedents can justly be broken in the interests of equity and common sense. It appears the Commission is even ready to grant a small increase. This, too, we believe, is further than they are justified in going at the present time —further than the electors are prepared to back them up. This is scarcely a time for favors to a few. Further, if these men had shown a proper appreciation of their responsibility which, being British citizens, they may naturally have been expected to do, they would have considered the possible dislocation of the operations of some of our factories, munition and otherwise, operating on war materials. This action at the present moment is not only selfish and disloyal, but may, conceivably, actually handicap the work of our brave soldiers. Men who strike to-day to better an already favorable position plainly do not appreciate the seriousness of the conditions with which we, as a nation, are confronted.

Safety Rules for the Industry

A conference on the proposed safety code of the Bureau of Standards met in session at the headquarters of the American Institute of Electrical Engineers in New York City during the past two weeks. The sub-committees on stations, line, utilization and operation have been in almost constant session, morning, noon and night, during the past two weeks and continued their deliberations on mooted points until a general agreement in each of the sub-committees on these points was reached. The greater part of the work assigned to the sub-committees on station, utilization and operation was completed Thursday, and it was expected that the line sub-committee would also be able to make its report.

Some misunderstandings arose over interpretations of the safety code, much of which was eliminated by re-wording those paragraphs dealing with the scope of the rules. It was made plain by the representatives of the Bureau of Standards that the code is not intended to be enforced in an arbitrary or inflexible manner by commissions or others having jurisdiction but is intended more as a complete specification of good practice in the electrical industry so far as safety is concerned.

At times difficulty was experienced in harmonizing the viewpoints of conflicting interests, telephone, railroad and lighting, and while the code was not changed greatly in principle, a number of alternate methods were adopted to meet variations in practice in various sections of the country. Some very important modifications were effected especially in the grounding of low-potential circuits, the potential at which grounding has been made compulsory being raised from 150 volts to 300 volts. Telephone companies will have to protect against constant-potential systems of 7,500 volts instead of 5,000 volts, and the limit on constant-current circuits will probably be raised from 7.5 amp. to 10 amp.

Revised copies of the proposed code will be submitted shortly to the members of the industry taking part in the conference and to a limited number of others, after which the Bureau of Standards will take up the matter with the public service commissions and municipalities. From the situation as it is at present it is doubtful whether the Bureau of Standards will be able to hold a public conference on the code in Washington until after January 1st.

Lighting Inefficiency

The inefficiency of modern illuminants, even with the marked advances of the very recent past, indicates the line along which progress must be sought. And the problem is, without doubt, a most difficult one. The transformation of electric energy into light means the transformation of the energy of electrons in motion into the energy of ether in motion. Unfortunately ether waves so produced are of a very varied character and amplitude and only a small percentage of them are effective in producing light. A very large proportion of the electric energy is transformed into ether waves which produce only heat, and many other waves of a nature not yet entirely understood are also produced in the transformation.

The problem before the field of illumination research,

therefore, resolves itself into how to effect this complete transformation of electric energy into ether waves of an amplitude which falls within the limits of the light spectrum. Not only that, but the distribution of the wave lengths must, to give the highest efficiencies, be distributed in a fixed ratio throughout the whole length of the spectrum. It is seen, then, that further advances in illumination efficiencies need not be looked for in "bunches." Any future progress along this line will in all probability only be the result of the most careful and systematic research—it will come only in small portions and at long intervals. Probabilities along the line of better control and distribution are fortunately vastly more hopeful of realization.

Coming Back With a Rush!

Gross earnings of the three Canadian railroads, the C. P. R., the G. T. R. and the C. N. R., for the last week of October and for the month of October reached notable dimensions. For the fourth week they were $7,147,358, or an increase of $2,413,017, which is at the rate of 50.9 per cent. over the corresponding period a year ago. The combined gross earnings of the three roads for all October were $21,656,192, an increase of $4,942,000 over September, of $7,464,000 over August, of $8,505,000 over July, and of $8,790,000 over June. Compared with a year ago, the increase was $5,519,000, or 34.2 per cent.

Progressive Jovians at Winnipeg

The attendance at the last Jovian luncheon, held in the St. Regis Hotel, Winnipeg, at which such prominent men as Controllers' Cockburn, Shore and McArthur, Secretary Smith of the Public Utility Commission, W. G. Chace of the Greater Winnipeg Water Scheme, H. Hartwell, of the Pierson Engineering Corporation of New York, City Electrician Cambridge and many others, were present, clearly indicates that the luncheon held every other Wednesday appeals to the active, serious minded men of Winnipeg. It speaks well for Jovianism when the principles of this organization and the manner in which these luncheons are conducted receive the hearty support of a man so prominent as Judge Robson, who has, himself, delivered three addresses before this body during the last year. The luncheon usually lasts only an hour and a half, including the address, and thus fits admirably into the programme of even the busiest member.

The entertainment committee has been fortunate in securing excellent speakers on subjects of great interest. At the last luncheon Mr. J. B. Hugg, barrister, was the speaker, taking as his subject, "The Control of Public Utilities by Commissions." Great interest is being taken in this problem throughout Manitoba, Saskatchewan and Alberta. Mr. Hugg is being retained by the Manitoba Public Utilities Commission as legal counsel, and consequently was well qualified to handle his subject.

"The principal utilities commission law," said Mr. Hugg, "is that no utility franchise shall be capitalized." He said that in Canada the first thorough-going public utility act was that passed in Manitoba. This province was followed by Alberta. He maintained that the Manitoba Act was a most comprehensive one. He followed this assertion by reciting some of the regulations laid down by law for the utilities commission to follow. Before the passage of that law, a telephone or telegraph company could set up a pole in one's house or back yard, and one could do nothing but grin and bear it. During the course of his address, the speaker asserted that the general opinion seemed to be that municipal utilities should be as much controlled as privately owned ones. Utilities commissions had large powers of investigation on their own initiation. Mr. Hugg stated that on the whole he did not think that there is any disposition on the part of privately-owned utilities to object to the control of a commission.

New Officers Elected

The following new officers were elected for the ensuing year:—president, J. F. S. Madden, district manager of the Canadian General Electric Company, Winnipeg; vice-president, E. H. Smith, of the Canadian Westinghouse Company; executive committee: H. Long, elec. supt., Winnipeg Street Railway; A. E. Esling, manufacturers' agent; J. Henry, supt. of Fire and Police Signal System; W. G. Vogan, Northern Electric Company; secretary, W. H. Reynolds, Eugene F. Phillips Electric Company.

At the next meeting an address will be delivered by Mr. Hartwell, of the Pierson Engineering Corporation of New York. He will deal with the "Control of Public Utilities by Commission, from an Investor's Standpoint." It is anticipated that a further address will complete this series dealing with the problem from both standpoints.

Secretary for Electrical Branch C. S. C. E.

Mr. W. H. Reynolds, secretary of the Jovian Order, Winnipeg, has also been elected recording secretary for the Electrical Section of the Winnipeg Branch of the Canadian Society of Civil Engineers. A splendid programme has been drawn up by the executive committee for the ensuing year as follows:—

October 13th.—"Electric Signal System as a Factor in Fire Protection," by Fred A. Cambridge.

November 10th.—"Wireless Telephony," by J. F. M. Wilson.

December 8th.—"Application of Curves, Charts and Graphs to the Analysis of Engineering Problems," by F. H. Martin.

January 12th.—"Telephone Transmission, Construction and Distribution of Cable Plant," by H. E. Brockwell.

February 9th.—"Application of Synchronous Condensers for Line Regulations," by F. H. Farmer and E. V. Caton.

March 8th.—"A Modern Fire and Police Signal System," by F. A. Cambridge.

April 12th.—"Mercury Arc Under Atmospheric Pressure," by Prof. J. W. Dorsey.

May 10th.—"Public Utility Development," by H. Hartwell.

Laurentide Power Company Limited

At a special meeting, held in Montreal, the shareholders of the Laurentide Company approved of the incorporation of a separate company to operate the new hydro-electric development at Grand'Mere, P. Q. The name of the company is the Laurentide Power Company, Limited, the capital being $10,500,000, with a bond issue of $7,500,000; the Laurentide Company will receive 70 per cent. of the stock. A few days prior to the meeting the plant was visited by a large party of Montreal stockholders, who were able to see the first unit of 20,000 horse power in operation. Work is being carried on day and night, in order to complete the plant, there being an immediate market for 60,000 horse power. The power house is practically complete, the machinery is being installed as rapidly as possible, and the dams, to give an additional 30 feet head of water, are nearly ready. After looking over the work, the party left for Shawinigan, where they inspected the plant of the Shawinigan Water and Power Company, under the guidance of Mr. Julian C. Smith, vice-president of the company.

Describing Cedars Rapids Plant

The development and construction of the hydro-electric plant of the Cedars Rapids Power and Manufacturing Company is being described in three papers read at the meetings of the Canadian Society of Civil Engineers, Montreal. The first paper, by Mr. Henry Holgate, was read at the meeting of the Society on November 4; Mr. Julian C. Smith will describe the hydraulic features on November 18, and Mr. R. M. Wilson the electrical design on December 2. Mr. Holgate's paper discussed the preliminary work in connection with the organization of the company, the physical character of the St. Lawrence and the Cedars water power, and the litigation which followed the expropriation of certain lands. The award of the arbitrators was taken to the Privy Council, who gave judgment for the company in one case and remitted two others to the arbitrators on the ground that the principle on which the award was based was not the right one. The company claimed that the land was only worth its agricultural value, while the owners contended that they were entitled to a price calculated on the value of the land as part of the undertaking. The case is not yet settled. The experience of the pilots, said Mr. Holgate, was that the work had improved the navigation of the river. Further precautions were being taken to protect the plant from frazil ice, and he was convinced that these would be successful. The work was completed well ahead of time and within the estimated price. Mr. Holgate also referred to the excellent work of Messrs. Julian C. Smith and R. M. Wilson in the design and construction of the plant.

Mr. Julian C. Smith stated that Mr. Holgate had done a large amount of valuable preliminary work and had outlined the design of the plant. Mr. Smith also spoke of the importance of developing our water powers in relation to the conservation of natural resources. It meant a valuable saving of coal, the utilization of power which would be otherwise wasted, the employment of a large body of men, and a certain amount of comfort for the general public. The policy of leasing the water powers was to be commended, and as a Society they should foster the idea of further developing the water powers. Mr. W. J. Francis and Mr. J. Kennedy also briefly spoke.

Address Your Mail Correctly

In order to facilitate the handling of mail at the front and to insure prompt delivery it is requested that all mail be addressed as follows:—

(a) Regimental Number ... ...
(b) Rank ... ...
(c) Name ... ...
(d) Squadron, Battery or Company .. ..
(e) Battalion, Regiment, (or other unit) Staff appointment or Department ... ...
(f) Canadian Contingent ... ...
(g) British Expeditionary Force ... ...
(h) Army Post Office, London, England ... ...

Unnecessary mention of higher formations, such as brigades, divisions, is strictly forbidden, and causes delay.

Mr. Justice Britton has dismissed the appeal of the city of Peterborough against the award of the arbitrators in connection with the expropriation of the distribution system of the Peterborough Light and Power Company, in which the city was required to pay some $155,000.

The Turn of the Tide

Canadian bank clearings for October aggregated $785,814,909, the biggest showing since December, 1913.

IN THE PUBLIC EYE

The Kaiser's birthday will soon be here and we anticipate the United States will again cable its "congratulations."

Ford says Canadians must buy his cars. There are many who haven't and many more who wouldn't, now.

A word of warning to the gamblers in war stocks may not be out of order. What would happen to the market if peace were declared to-morrow? Don't forget at least that you are betting on a long duration of the war.

That talk about constructional operations in winter is staged at the right moment, if any confidence can be placed in the weather prophet of Paris, who has staked his reputation on the forecast that winters will be unusually cold for twenty-six years.

Are you saving up for the coming Canadian War Loan? That we give this loan our support to the limit of our resources, if necessary, is our right and privilege. It will be to our profit, as the rate of interest the loan will doubtless carry would, two years ago, almost have placed it in the class of "speculations."

Armand Lavergne refuses to lend his assistance in a war which England is fighting for our existence as much as her own. His arguments indicate weakness alike of mind and loyalty. Men whose expressed sentiments have carried much less weight are at the present moment interned in Canada. How his attitude will "hearten" the Huns to fight on! Yet this man still holds his seat in a legislative assembly, and a rank of lieutenant-colonel, in an empire he refuses to defend.

The Australian Government has pledged itself for good against articles of German manufacture. Doubtless this will be followed by a readjustment of import duties. Meanwhile German firms are bidding on the construction of radial brick chimneys and other business in Canada. And there is a faction in the Toronto City Council disposed to consider a literal interpretation of "Love your enemies." May we do unto the Germans as they have done unto us—only, in future, may we do it first.

"To my mind there is something absolutely revolting in the idea of anybody making profits out of the nation's agony." These words of the Chairman of the Steel Company of Scotland are quoted by The Ottawa Citizen in an article dealing with war profits in Canada, and particularly with the operations carried on under the direction of the Dominion Shell Committee. What of these charges, if true? Has this any bearing on the discussion over the propriety of singing "O Lord, our God, arise, Scatter our enemies!"

I read in a New York paper the other day that Frank Skinner, the New York City Consulting Engineer, had just returned from a five months' tour of London, Paris, and Le Havre, in the course of which he secured orders from the Belgian Government for several hundred portable interlocking steel houses, to be manufactured in the States, and also got a British contract for steel piles for protecting military trenches. Doesn't this sound like "Wake up, Canada!"? Canada's keenest business man should be at the head of our Department of Trade and Commerce.—Searchlight.

Approved Central Station Signal Systems

As a factor in fire prevention—Comprehensive paper before the Electrical Section of the Winnipeg branch of the Canadian Society of Civil Engineers

By Mr. F. A. Cambridge

Every year and every month of the year we are face to face with a tremendous fire waste in Canada and the United States with an annual loss in property values of two hundred and fifty million dollars or at the rate of five hundred dollars per minute. The fire insurance companies have for years been carrying on a campaign of education for the better protection and prevention of fire. More and more the business man of to-day is becoming a convert to these teachings, and is realizing that a fire is the last thing in the world that he wants in his factory. He is appreciating the fact that the annoyance, the inconvenience, and the heavy loss of business that invariably follow in the wake of every fire are things that fire insurance does not always cover. More and more are the ideas of fire prevention assuming concrete form in the better construction of buildings, in effective fire stops, sprinkler systems and the central station signal service.

While it is only within recent years that central station service has really become an important factor in fire protection it has developed so rapidly that to-day the American District Telegraph Company has, in the United States, central stations in over 600 cities and towns and have under protection over three thousand million dollars worth of property. In the city of Chicago alone there are over 25,000 central station night watch and fire alarm boxes. In the Union Stock Yards there are over 1,600 night watch boxes and 162 watchmen report to a central station maintained and operated for this one industry.

The Dominion Messenger & Signal Company is a Canadian corporation using the same devices and operating along the same lines as the American District Telephone Company in the United States. It has offices in Montreal, Toronto, Winnipeg and Hamilton, and is the largest company in Canada operating central station service as well as the only company using exclusively devices approved by the National Fire Protection Association and installing its system as well as operating its service on standards adopted by that association. Although this company has been operating but six years it has under its protection in the four cities named property value of over two hundred million dollars.

A Brief Review

In order to fully appreciate the service as it exists today a brief review of the development of this service seems advisable. Before the advent of the central station system there had been used what is commonly known as the clock system for checking night watchmen. There are to-day scores of different makes of clocks, portable, mechanical and electrical, but all based on much the same principle. Nearly all make use of a paper dial divided into the twenty-four hours of the day so arranged on the mechanism of the clock that the dial revolves at about the same speed as the hour hand of any ordinary time clock. A means of puncturing these dials is provided and the paper dial forms the record of the watchman's movements during the night.

Among special hazards I presume that few are viewed with more suspicion and alarm by fire underwriters than the packing house plant. The very nature of the business and the construction of the building under early methods made fires of frequent occurrence. It was because of the necessity of better fire protection in risks of this class that central station signal service had its beginning. About thirty years ago the firm of Swift & Company, Chicago, discovered that their watchman was finding it possible to evade the checking system then in use. In an effort to improve conditions they called on the telegraph company to install some of the ordinary messenger call boxes which you have all used with more or less success. The watchman merely pulled down a handle of the box and in so doing turned in a signal to the telegraph office where the time was noted on a crude form of report. This arrangement had an advantage over the old system in the fact that a failure on the part of the watchman to properly patrol the plant was known in a matter of fifteen or twenty minutes instead of several hours afterwards as under the old clock system. This service was gradually extended and companies formed for handling central station service, together with messenger service in the larger business centres. There were no standards; boxes and other apparatus were poor, and the service was not regarded as a very serious factor in fire protection.

Box with Special Dial

Then some genius designed a box with a special dial and a movement so arranged that a messenger, a carriage, a doctor, the police, the fire brigade, or an express waggon could be called merely by adjusting a pointer and pulling the handle of the box. However, sometimes this multiple service box became confused and mixed in the duty it was called upon to perform with surprising results. On one occasion a gentleman desiring to take his friends for a drive was astonished a few minutes later to see an express waggon back up at his front door. Sometimes the fire department would respond when only a doctor was required. Of course both can do a great deal of damage at times, but no one ever wanted a fire engine for a case of appendicitis or an eye and ear specialist to put out a fire. Furthermore, the arrival of the police was at times disconcerting and required explanation to the neighbors. So it was, that in trying to please everyone the service was of little value and soon became discredited.

The time arrived soon after when some keen-sighted individual saw the possibilities of thoroughly efficient central station service, and what is now known as the American District Telegraph or A.D.T. System got its start. Engineers were set to work designing new boxes and special apparatus to cope with the problems of a fire protective system. Standards of installation and uniform service were adopted. The old scheme of a simple metallic system was discarded for the McCullough or combined metallic and grounded circuit which makes it possible for the central station to receive a signal from all or any of the boxes on the line though the line itself may at some point be broken down. Special fire alarm boxes were designed to save the watchman the necessity of going to a city box to turn in an alarm. These were superceded later on by the combination night watch and fire alarm box that was later submitted to the Laboratories, given the official approval of the N. F. P. A., and is in general use to-day in connection with all approved central stations.

With this box the watchman turns in his night watch signal by means of a key, thereby transmitting a certain number to the central station. By merely breaking the glass in the door and pulling down the lever inside, the number, in addition to the special fire alarm signal, is transmitted seven times and is turned in to the fire department

headquarters. As operated to-day the approved central station night watch system is a thorough check on the movements of the watchman, and at the same time provides a ready means for turning in an alarm of fire at any time of the day or night. In this particular, the old clock system only went half way. If for sake of argument, we agree that the watchman was kept awake, he had no means of turning in an alarm if he found a fire. A watchman is employed in 95 cases out of a hundred for the sole purpose of guarding the property against fire, and the central station system not only keeps the watchman awake and on the move, but provides him with apparatus for calling in the very aid that he needs if a fire is discovered. If a watchman fails in his signal the central station sends an officer or roundsman to the plant to ascertain the cause. If asleep the watchman is awakened; if ill or incapacitated, aid is procured and the plant patrolled. Many and many a watchman has been found by the runner of the central station, ill, with a broken limb, or unconscious and in a serious condition. Sometimes even death overtakes him on his rounds, and the watchman is found by the runner from the central station. In one case that I know of the watchman was found unconscious and overcome by gas. In another he had fallen down a pit and broken a leg. In the past six months there have been two cases of watchmen having been found dead on the premises by the roundsman from the central station. One was a case of heart failure, and the other death came through falling down an elevator shaft. These facts all reach the insured and the insurance board having jurisdiction by means of the daily report rendered by the central station.

Every Box a Fire Alarm

A most important feature is the fact that every box is a fire alarm box. In case of fire the watchman knows instinctively where to turn in his alarm, as he turns in his signal every hour from the same box. If he runs out to the corner to turn in an alarm from the city box he is obliged to wait the arrival of the fire department in order to direct them to the fire. All of this time might be used to advantage by the watchman in trying to extinguish the fire with hose, water-pails or such other means as might be at hand.

Another advantage is the absolute necessity for the watchman to make his rounds. I have frequently known of a watchman who resigned his position as soon as the central station was installed. Not very long ago an endeavor was made, without success, to install this system in a certain Toronto factory. One night fire broke out; the alarm was turned in by an outsider, and when the department arrived they found the watchman fast asleep. In sharp contrast with this case is one of a Toronto piano factory having the central station system. The watchman in making his two o'clock rounds discovered a fire on the third floor under fairly good headway. Turning back ten feet he pulled in a fire alarm and in a few seconds' time was at work on the fire. Although the fire department was on the ground some three or four minutes after the alarm had been sounded, the fire had been entirely extinguished by the watchman. In still another case a watchman was arrested at midnight for being drunk on the street and lodged in jail for the balance of the night. Imagine the astonishment of his employers to find the next morning that the signals were registered on his clock until 6 a.m., notwithstanding the fact that he had not been on the premises for six or eight hours. The natural conclusion is that an outside check, such as the central station service, is a necessity.

There is still another advantage in the central station service that is not generally appreciated. Daily reports are made by the central station company to the secretary of the Board of Underwriters having jurisdiction. On this report are shown all watchmen's failures and the excuse in each and every case. Generally speaking the managers of the protected plants are sufficiently alive to their own interests to see that proper service is maintained. If they are not, however, and improper watchman service continues, the secretary of the Board has an opportunity of requesting an improvement. By this arrangement the insurance companies themselves know that a proper watchman's service is being installed, and that negligent or careless men, or men given to dissolute habits, are not being retained as watchmen of plants on which they are carrying a line of insurance.

Weaknesses in Sprinklers

While improvements were being made in watchmen's service, the installation of the sprinkler system was becoming more general. Its worth as a fire extinguisher and a fire stop had been thoroughly proven, and its greater use encouraged by substantial reductions in insurance rates. Along with the advantages, however, there was soon found to be some very decided disadvantages in the sprinkler. Perhaps we might call them weaknesses. Of these weaknesses, the most important and the most harmful was the disposition of a sprinkler system to keep on spouting water long after the fire which had opened the head had been extinguished. It was found that in the colder climate the water in the tank, if not attended to, would freeze, and it was nearly an impossible task to thaw out a tank if it ever got a good start in making ice. It was found that gate valves were turned off and parts or even the entire system rendered valueless. Right here is where the engineers of the central station stepped in and devised means for correcting these weaknesses in the sprinkler system itself. When sprinkler systems were first installed it was considered sufficient protection by the insurance authorities to have a bell on the outside of the building connected to the alarm valve. The idea was, of course, that when a sprinkler head opened some chance passer-by would immediately call the fire department. Just how a man would know that this was an alarm caused by the opening of a sprinkler head was never explained; nor how this passer-by would distinguish the alarm from an elevator bell or from a bell of a thermostat system was never made clear; or just what would happen if no one chanced to be passing by, still remains a mystery. The necessity for some better protection was brought forcibly to mind by several very heavy losses by water damage, although the loss by fire was insignificant, in nearly every case loss being due to the fact that no one was on hand to shut off the water after the fire had been extinguished. Again, these outside bells were often neglected by the man in charge of the sprinkler and failed to ring when needed; or, as was more often the case, rang when nothing out of the ordinary was taking place. The alarm valve was unreliable and gave a great many false alarms, caused by water surges and variation in pressure. In fact even up to the present date there has never been a single alarm valve approved by the Laboratories. As a further indication of the weaknesses in the sprinkler service before the adoption of what is known as the Sprinkler Supervisory Service, the following figures are taken from a report of the underwriters of the city of Chicago before the introduction of this service.

Tabulation of Inspections

A tabulation of inspections made by the Superintendent of Inspections of the Chicago Underwriters' Association for the period of one year reveals the following:

Frozen tanks	20
Shut off valves found closed	35
Low water and leaking systems	22
Local alarms out of order	numerous

Fully 20 per cent. of the sprinklered risks under the super-

vision of the Chicago Board are shown by the report to have been out of order.

The first attachment for central station service consisted of a small trip magnet box whose circuit was closed by the action of the alarm valve and at the same time the outside bell started to ring. If the sprinkler system was subject to water surges the central station had a great many false alarms. If the fire department was called out on every alarm they would soon refuse to answer any calls at all. In almost every large city the demand came for a more reliable system, and this has been solved by the sprinkler supervisory service, and yet sometimes one meets a chief inspector who insists that the old alarm valve which has been rejected by the Laboratories is perfectly satisfactory.

Alarm and Supervision

The object of this system is not only to give a reliable alarm in the case of the opening of a sprinkler head, but also to exercise a supervision over the entire system and to keep it in perfect working order so as to be always ready for a fire. When a flow of water takes place in the sprinkler system equal to the opening of one sprinkler head a waterflow signal is transmitted to the central station, and also to the central fire hall. In addition to the response of the fire department men are sent from the central station to the risk with the keys to admit the firemen. These men are familiar with all the shut-off valves in the building so as to be able to turn off the water as soon as the fire is out and save all possible damage. A head can then be replaced and the water turned on again. The transmitters rewound and the plant again placed under full protection. A list of the addresses of the employees of the firm is kept on file so that they can be notified by the central station. Manual boxes are also provided at tbe main exits of the plant so that the fire department can be summoned in the event of a fire starting in some adjacent building. In case a gate or shut-off valve should be closed a special signal is transmitted to the central station, and the reason for this is immediately ascertained. When this valve is again opened a restoration signal is transmitted to the central station, and it is known that the system is again in normal condition. Thus the danger of water being turned off and forgotten is avoided. Of course, if a system has the water turned off it is worthless as fire protection. Again, if the water in tbe pressure or gravity tank becomes low, a signal is immediately sent in to the central office and the engineer is notified. When the normal level is restored a restoration signal is received at the central station. If the water in the tank becomes dangerously cold a temperature signal is transmitted so that the engineer can be notified to heat up his tank. When the temperature is safe again a restoration signal is received. A signal is received when the air pressure in a dry system or pressure tank falls below safety and a restoration signal when normal condition is reached. Attachments can also be made to boilers for fire pumps or even the sources of current for electric fire pumps, to show any condition out of normal. Two circuits are used from the protected plant to the central station. One for the fire alarm signal and one for the supervisory signal. Daily reports to the head of the sprinkler risk department are made of all signals received, and this daily report is frequently of great value to the underwriters. For instance, a break in a sprinkler pipe occurred in a risk protected by our system early one Saturday afternoon. The company who installed the sprinkler wanted to leave the water shut off and the plant unprotected until Monday. We notified the chief inspector who insisted on the work being done at once, and consequently it was completed before midnight, and the plant again placed under protection. It seldom happens that the man in charge of the sprinkler is an engineer, and more often a caretaker only is employed. It is in such situations that the knowledge and advice of the men employed at the central station become of great value; not only to the owner of the plant but to the insurance board that may be interested.

Records of 60 Offices

As an illustration of the scope and importance of the sprinkler supervisory service as operated to-day by approved central stations, I am showing below the records of sixty offices operated by the A. D. T. Co. in the United States for a period of three months ending August 31st of this year. Your attention is called particularly to the number of sprinkler heads supervised, the number of gate valves closed, and the number of waterflow signals received from fire and other causes. Multiply these numbers by four to get a real understanding of the operation of the service in a year, and the importance of the sprinkler supervisory service assumes even greater proportions than before.

	3 mos.	12 mos.
Gate valves closed	2,236	8,944
Low water in gravity tank	470	1,880
High or low pressure	2,114	8,456
High or low temperature	5	....
Low steam pressure	158	632
High or low water-pressure tank	298	1,192
Fire	39	142
Water-flow signals for causes other than fire or test	757	3,028
Buildings equipped	1,174	....
Sprinkler heads supervised	1,576,865	....

Before even the night watch system had been devised or the sprinkler supervisory service thought of, attempts were being made to protect buildings by an automatic fire alarm system. Probably the most common and most generally used device was the mercury tube; patterned after the common everyday thermometer with the addition of having fused in the glass tube itself two small wires which would complete an electric circuit in the event of a considerable rise in temperature. Altogether there are about four hundred different automatic systems on the market, but nearly all are alike in the fact that a rise of temperature to a point ranging from 125 degrees F. to 165 degrees F. causes the thermostat to operate. The linear co-efficient of expansion of iron is — .0000059, and of copper — .0000095 degrees F., and as this expansion is so very small the thermostat must be very sensitive if small or become unsightly if large.

Fell into Disrepute

The result was that these systems were so liable to give false alarms that they soon fell into disrepute. The jarring of the building caused by an elevator or the dropping of a case of goods on the floor would frequently send in an alarm. A ray of sunlight striking one of these thermostats would have the same effect as the hottest kind of a fire. These systems were seldom fully installed and frequently many parts of the building such as the space under stairways, attics, etc., were left unprotected. The rules of the N. F. P. A. call for a thermostat for every 100 sq. ft., but in the case of some of these systems I have found the average ranging from 300 to 800 sq. ft.

Notwithstanding these defects, occasionally an alarm was received from one of these systems which saved large losses, such results as were obtained indicated that a reliable automatic fire alarm system, properly installed and maintained, would be of great value in fire prevention. After much research and experimenting, the central station engineers finally brought forth out of this chaos a system so nearly perfect that the Underwriters' Laboratories, after thorough field and laboratory tests gave it the stamp of their approval.

This new system is known as the Aero or compensating

fire alarm system. Briefly it consists of a copper tube scarcely one-eighth of an inch in diameter placed along the ceiling of the protected plant, and terminating at one end in a coil and at the other in a small brass device called a detector. In this system it was found necessary to break away from all previous ideas. Iron, copper, and other metals as well as mercury expand such an infinitesimal amount for certain rises of temperature that they had to be discarded. A medium was sought and found which gave a large increase in volume for a small change in temperature. Common ordinary air that we all breathe was found to be the medium most adapted to this service. Air doubles its volume in a rise of 491 degrees F., or in other words has a co-efficient of expansion of about .002. Quite a difference when compared to a small continuous tube, giving the advantage of a large length of tubing influenced by the heat of the fire with a corresponding increase in the expansive power of the air within.

None of the old systems had any compensating features, which was a decided defect in their construction. The sun shining through a skylight and striking a thermostat would cause an alarm in the same manner, although not quite so quickly as a fire in the room. In the Aero system this defect was remedied by making the system compensating. That is, it does not give an alarm at a fixed temperature but on a specified rate of rise in the temperature. The system has been approved by the Laboratories. If a fire starts in a room where this system is installed the expansion of the air in the tubing is rapid, and soon acts on a silver diaphram, making an electric contact and thereby sending in an alarm. The compensating device consists of a small glass tube introduced into the expansion chamber of the detector and containing an opening to the outside air calculated in size to one thousandth part of an inch. A slow rise in temperature, such as the change ordinarily occurring as from night into day or from winter into summer has no effect on the diaphram as the expansion is relieved by the escape of air through the small vent mentioned above. The coil at the opposite end of the tubing is for testing purposes, and consists of this same copper tubing having a number of convolutions or turns proportionate to the number of feet used in each section. Into this tubing an electric heater can be thrust and a rapid expansion of air secured in the same manner as in the case of a fire. In addition to the instruments for transmitting the alarm an annunciator is placed on the front of the building which shows the particular floor or section in which the fire is burning.

This system has only recently come into use but its success is already assured and its installation is making rapid progress in such risks as are not already provided with the sprinkler or night watch service. The system is so new in Canada that we are able to supply but little information as to results. The very fact, however, that the Underwriters' Laboratories after testing the system under most exacting conditions for nearly two years have given it their approval is sufficient evidence that it has all the merit claimed for it.

Electrical Features of Knox College

Complete with light, power, Bell telephones, intercommunicating telephones, time clocks and program signal system—Most modern equipment, efficiently installed

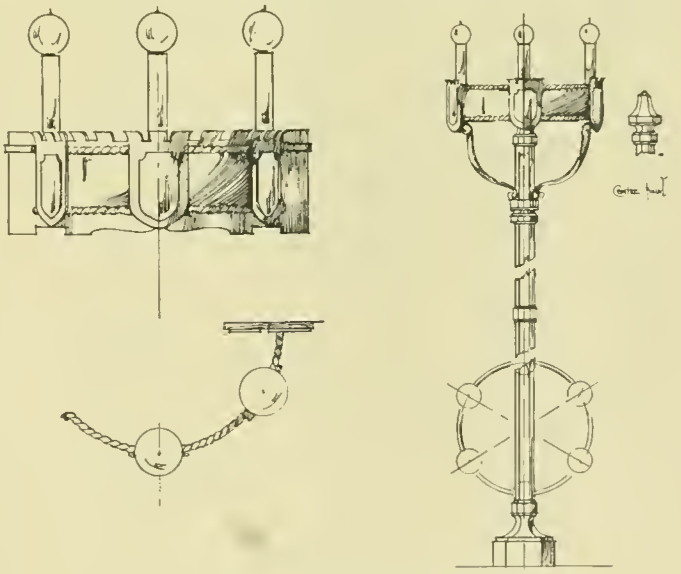
A brief description of the power and lighting installation in Knox College, Toronto, just recently completed, will be of interest. The wiring is on the three-wire system, supplying 110 volts for lighting and 220 for power. All wires are installed in standard iron conduit. All conduits entering outlet switch, receptacle and panel boxes are provided with bushings on the inner and approved lock-nuts on the outer side of the boxes, thus securing a good ground for the entire conduit system. All branch conduits terminate in approved steel outlet boxes of standard type, except in the stack-room, where condulet fittings are used. Ceiling outlets are provided with "T" hangers for fixture support.

Each power feeder terminates in an approved two-pole fused knife-switch enclosed in an iron box with hinged door and catch. Motor switches are installed within five feet of the motor.

All outlets for base receptacles are provided with Diamond H flush base receptacles and plugs, the face-plates being finished to match the surrounding hardware. The switches are flush type, single-pole, three-way, and lock-key, depending on location, and of standard type. Where two or more switches are placed at the same point they are mounted in gangs with one face-plate. Lock switches are installed at the various outlets for controlling the vacuum cleaner motor.

Corridor lights on the ground, first, second, and third floors in the residence are controlled from panels in the basement, and branch circuits are so arranged that a considerable amount of latitude is required in the lighting of the various corridors and rooms.

The light feeder wires are installed in vitrified clay conduits between the main switch and the main basement panel. These feeders are standard, paper-insulated, lead-sheathed, two or three-wire, ending in standard potheads attached to lead sheathing with wiped joints, heads being properly filled with moisture-resisting compound before sealing. All branch circuit wires and cables are continuous from outlet



Fixtures in Library—Knox College, Toronto.

to outlet. The branch wires are No. 14 rubber-covered, double braid.

The following panel boards are installed:—Panel A, 20 branch circuits, end feed; Panel B, 30 circuits and one 100-amp. fused sub-feed; Panel C, 30 circuits and one 50-amp., 3-wire fused sub-feed circuit; Panel D, 30 circuits and one

25-amp. fused sub-feed; Panel E, 24 circuits, end feed; Panel F, 22 circuits and one 50-amp. fused sub-feed; Panel G, 40 circuits and one 50-amp. fused sub-feed; Panel I, 16 circuits and end feed; Panel K, in two sections, sub-distribution fused circuits, no switches.

The contract also included the provision and erection of all necessary conduits, pull-boxes, junction and instrument boxes for the Bell Telephone Company's service. The junction boxes for cable terminal connection strips have wood backs, and are of the same construction as the pull boxes used for the lighting system. Telephone outlets were left in the Principal's office, the business office, the porter's office, and in the library. The Bell switchboard is installed in the business office, and connected to the Principal's and librarian's outlets. The porter's office has direct connection with the Bell central exchange.

A complete intercommunicating telephone system, with the necessary conduit, pull and junction boxes, cables, connection strips, outlet boxes, instruments, and necessary wiring, was also included in the electrical contractor's tender. Standard automatic switchless intercommunicating central energy telephone sets were installed at the following points: —Principal's office, desk set, 10 station; business office, desk set, 10 station; Librarian's office, desk set, 10 station; porter's office, desk set, 14 station; kitchen hall, flush wall set, 10 station; steward's hall, flush wall set, 10 station; janitor's room, flush wall set, 10 station; hospital, flush wall set, 10 station; corridor outside professors' rooms, flush wall set, 10 station; on second floor, Academic Building, 10 station.

In each reception room of the north, centre, and south residences, and in the common room, standard single-station wall sets are installed which connect to the porter's office telephone only.

Two sets of storage batteries are installed in the battery room—one for signalling, and one for talking.

A time-clock system has also been installed, and a signal bell system. Two sets of storage batteries are also installed for the master clocks, two sets for the programme clock, two sets for the programme relays, and two sets for the signal bells. Batteries are all mounted in sand trays set in a special battery room.

Metal conduits were furnished by the Greenfield Duct and Conduit Company; panels by the Canadian Krantz Electric and Manufacturing Company; wires and cables by the Imperial Wire and Cable Company; intercommunicating telephones by the Northern Electric Company; electric clocks by the Howard Clock Company (of Boston and New York); storage batteries by the Howard Clock Company; vacuum cleaning system by the Zimmer Vacuum Machine Company; electric fixtures by McDonald & Willson, Toronto. The installation of all electric equipment was made by Keiths', Limited, Toronto.

The Efficiency of Modern Illuminants

Comparative review of efficiency of different light sources—Much energy yet going to waste in form of heat—Recent advances in lamp manufacture

By Mr. E. V. Pannell

The great advances in the science of electric illumination accomplished by the introduction of metal filaments, quartz and mercury vapour lamps and the recent development of the nitrogen filled tungsten lamp place the present position of the art nearly one hundred per cent. in advance of the early carbon lamps of Swan and Edison. During the last ten years very close study has been made of the science of light production and particularly close application has been made of theoretical principles in actual experiment and practice. Light is generally understood as a vibration of the ether travelling in waves in all directions in space from its source; as a vibration it has a perfectly definite frequency and amplitude. This amplitude, or as it is more commonly termed, wave length, is measured in microns (one-thousandths of a millimetre) and lies between about .38 for violet light and .76 for red. Light also possesses radiant energy which is closely associated with heat. When a body is heated up it gradually assumes a grayish glow which becomes barely visible at about 450 degs. to 500 degs. C. Heating further the dark red region is attained and with increasing temperature the cherry red and orange stages. If the body can be heated sufficiently without volatilization it may be brought up to the blue hot stage where it will emit perfectly white light, a blend of the complete spectrum. This is the condition under which an incandescent filament glows.

Experimenting with a thermo radiometer in various parts of the spectrum from an artificial source of light Stefan Boltzmann found that the energy radiated from the source was proportional to the fourth power of the absolute temperature. In other words, suppose an incandescent filament to be raised from 720 degs. to 1,720 degs. C. (1,000 to 2,000 absolute approximately) the light energy radiated would be increased no less than sixteen times. This refers to ordinary white light being a blend of the complete spectrum and radiated from a theoretical "black body" or one in which there is no absorption or reflection. The distribution of the energy over the spectrum is found to be not uniform but more or less of the form shown in Fig. 1. This curve represents the energy emitted in various parts of the spectrum by a source of "white" light and the important feature to note is that by far the greater part of this energy is wasted. The dominant wave length at which the energy is a maximum is greater than .76 which is the greatest visible wave length and as a consequence most of the energy is radiated in the invisible part of the spectrum. Now for efficient illumination it is necessary for the greater portion of the curve to fall within the visible limits, otherwise, instead of producing light, much of the energy will be lost in evolving heat waves in the infra red region.

These facts, whilst purely theoretical, have an intensely practical bearing. Any lamp, whether arc, incandescent or vapour, absorbs a certain number of watts which are all converted into heat, light or chemical waves. The object of the illuminating engineer is to transform all the energy supplied into light waves pure and simple, or, in other words, those waves having a length of vibration between .38 and .76, thus securing a high efficiency in candles per watt. As already seen, the quantity of energy radiated is enormously increased at higher temperatures. A still more important fact known as Wien's law was demonstrated in experiment by two physicists, Paschen and Wanner, viz.: that the product of the dominant wave length with the absolute temperature is a constant. The interesting result of this law is best seen from the curves in Fig. 2, which is practically the same as Fig. 1, but plotted out for different temperatures. Increasing the temperature therefore brings the curve more and more within the visible limits, thus increasing the useful light energy and cutting down the useless infra red vibrations. It was this fact which stimulated the introduction of highly refractory metallic wires and filaments in place of

carbon, and which standardized the "one watt" lamp. The temperature of metal filaments in a vacuum globe is of the order of 2,000 degs. C., whereas the temperature necessary to bring the dominant wave-length into the visible spectrum would be about 3,500 degs. C. The efficiency is therefore still far below what might in theory be attained. Higher temperatures have, however, enhanced the efficiency from about .25 to 1.0 candle per watt.

Other methods of increasing the efficiency are open where a vapour arc is the source of illumination. Although not as widely adopted as seemed possible a few years ago vacuum tubes of the Moore and Cooper-Hewitt type represent the most scientifically perfect means of producing light vibrations. The tube is exhausted and charged with a residual gas; mercury vapour in the case of the Cooper-Hewitt and nitrogen or carbon-dioxide in the Moore. When a voltage is applied to the terminals the electronic discharge causes the gas to glow in the spectrum, one in the yellow orange, one in the green and the other in the blue violet. The result is an almost monochromatic glow which, although highly efficient, is objected to upon aesthetic grounds. The efficiency has been still further improved in the Uviol lamp of this type by the use of a quartz tube instead of glass; as is well known, glass is very absorptive, and where the highest efficiency is required quartz is substituted, thus permitting the temperature to be increased even to 4,000 degs. The drawback to this is the danger accompanying the radiation of the ultra violet vibrations which pass freely through quartz. In point of efficiency the quartz lamp gives about three candles per watt, which is about 50 per cent. better than the glass tube Cooper-Hewitt. The Moore tube using CO_2 gives a very white light and is in this respect superior to mercury vapour, but the efficiency obtained is only about .5 candles per watt.

Another example of selective emission by which one or more elements are introduced into the source of light so as to volatilize and respond with their natural vibration is provided by the flame arc. In this case the cored carbons are filled with salts of the required elements, usually magnesium, calcium or sodium. Testing with a spectrometer it will be found that the bright lines of these gases are present in the visible spectrum; thus the area of the energy curve is increased between the visual limits and the efficiency

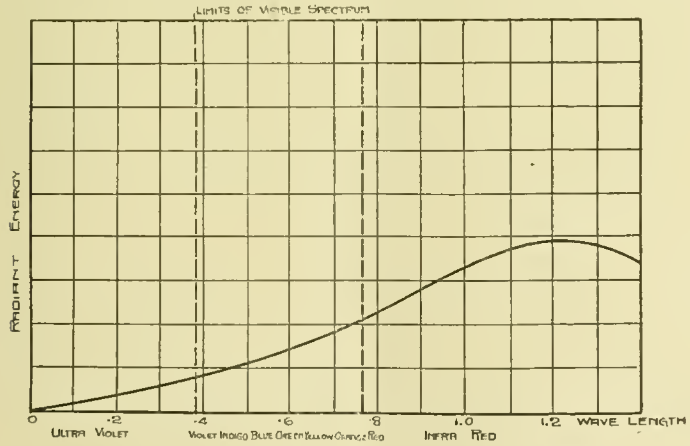


Fig. 1.—Energy radiated by an incandescent source of light.

of the source also greatly increased. The best of flame arcs still afford the most efficient practical form of illuminant, giving about 3 candles per watt.

Reverting to incandescent lamps, improvements during the last few years have included the production of drawn tungsten wire which supplants the earlier filaments produced by the old substitution process. Needless to say this affords greatly increased durability, and the tungsten lamp is now just as strong as the drawn tantalum wire lamps which were introduced some ten years ago, whilst giving higher efficiency. Trouble has been experienced, however, particularly in the large units, due to blackening of the bulbs, and several reasons have been adduced in explanation of this phenomenon. It is believed that an electronic discharge takes place through the residual gases in the bulb, resulting in deposition upon the glass, and although higher degrees of exhaustion have been employed, they have afforded only a partial remedy. Recently, however, the system of filling the bulb with an inert gas, such as argon or nitrogen, at atmospheric pressure has been widely adopted, until at the

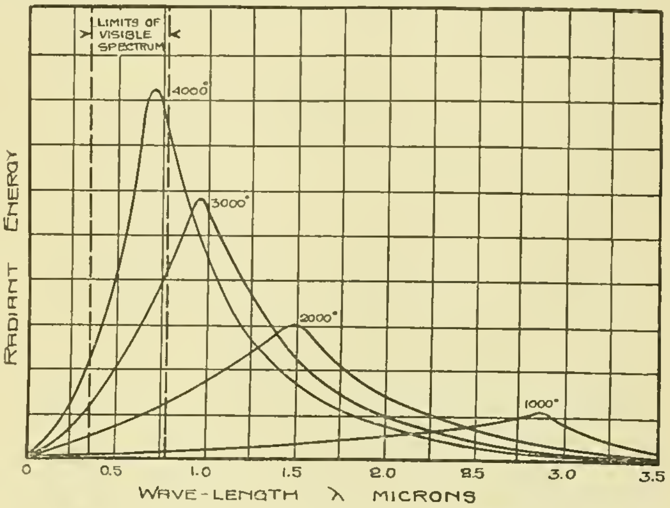


Fig. 2. Energy radiated from an incandescent body at different temperatures (absolute.)

present time it seems that the nitrogen filled tungsten lamps will become the standard for all units of 60 watts or over. Not only does the gas prevent electron discharge and evaporation of the filament, but it also permits a much higher temperature, it being a common thing to operate these lamps at nearly 3,000 degs. abs. As already seen, the prime requisite for high efficiency is high temperature; consequently, an efficiency of 2½ candles per watt is reached with the gas-filled tungsten lamp. This brings the dominant wave length almost within the visible spectrum. The higher temperature requires a larger bulb and the high intrinsic brilliancy necessitates special arrangements for diffusion and reflection, but with these precautions there is every reason to believe that the type of lamp under mention will to a great extent displace arc and vapour lights for ordinary uses.

Efficiency of Modern Illuminants

Type	Mean Spherical Candles Per Watt	Lumens Per Watt	Efficiency Per Cent.
Arc Lamps (Averaging 300 Watts)			
Open Arc (D.C.)	1.00	12.57	10
Enclosed (D.C.)	1.50	18.80	15
Flame (D.C.)	2.50	31.40	25
Magnetite	2.00	25.20	20
Vapor Lamps			
Mercury (Glass)	2.00	25.20	20
Mercury (Quartz) ...	3.00	37.70	30
Moore Tube (Nitrogen)	1.00	12.57	10
Moore Tube (CO_2)	.50	6.28	5
Moore Tube (Neon) .	1.40	17.60	14
Incandescent Lamps			
Carbon	.25	3.14	2.5
Gem Metallised	.33	4.15	3.3
Tungsten (Vacuum) ..	.80	10.00	8.0
Tungsten (Nitrogen) .. (300 Watt)	1.80	22.60	18.0

Note:—The above figures for efficiency are based upon a mechanical equivalent for white light of 10 mean spherical candles per watt at the lamp terminals.

Who's the Boss? — It's the Customer

by Mr. J. A. Sutton

If you were asked right quickly the question, "Who is your boss?" you would answer, "Mr. So-and-So." You are dead wrong; "It's the Customer." He is the real fellow behind the gun and in this paper I am going to show why he is. It occurred to me at first that the salesman, meter readers, complaint adjusters, etc., meeting customers face to face were the only ones to whom this would apply, but the customer is "boss" of the president down to the humblest employee.

You may ask why? Because he is the fellow who pays for the gas, electricity and merchandise sold by us and has shown on numerous occasions that he must be recognized as the one big fellow who for whom we are working.

He has even gone so far as to say that the prices charged for gas and electricity were too high, had a Public Service Commission appointed, an investigation made, with the results known very well by all of us. Of course, I am not trying to convince you that this action was right or proper; but only using it as a very forcible reason for the above apparently radical statement.

Had my question been, "To whom do you report?" your "Mr. So-and-So's" answer was right. You should not feel that in the company's organization you require a "boss"; but please do not overlook the real fellow—the Customer. He is your boss and is dealing with you every hour of the day; and you must learn how to furnish him prompt and satisfactory service all the time.

You will find that the customer is nearly always fair and reasonable. About one in a hundred is not. Win him over if you can. If this percentage of your boss is fair and reasonable, you have a "hang-up" fellow to whom to render a prompt and satisfactory service. Give it to him, he is entitled to do it—"he pays the freight."

Prompt and Satisfactory Service

This sub-head is the key-note to the success of our great organization and if lived up to strictly, you could not estimate its increasing value. What is it? To the salesperson it means to give the strictest attention to every detail in connection with an order secured and then see that the same is filled promptly and satisfactorily. If you make a promise, by all means see that it is carried out and do not make it unless you are sure that it will be fulfilled. You are continually in touch with the customer and you have the greatest opportunity of anyone in the company of seeing that the "boss" is kept in a pleasant and agreeable frame of mind. And you all know how nice it is to have the department heads in this shape—and how much better for the real boss! Of course, those selling on the inside do not have the opportunity of going as far into this matter as the regular district salesman. He is in touch with the customer all the time. If he sells some wiring or merchandise, it is an easy matter to call on the customer after its installation, to see if the same has proven itself satisfactory; and if not, to take up the complaint and see that the customer is satisfactorily served by us. Also in working among our customers, call on them from time to time; they will be glad to see you, and may have a complaint for you to take up and adjust. While those selling on the inside do not have this excellent opportunity, yet the manner in which you promptly and satisfactorily serve your customer when he or she comes to see you, will have a far-reaching effect in keeping the "boss" satisfied. To carry out the above you must be neat, clean, courteous, obliging and enthusiastic in your work.

The meter readers, complaint adjusters, etc., rank next to the salespeople in opportunity to supply satisfactory service to the customer; and if all would perform their duties as they should, our well-organized complaint department would dwindle down to one man with practically nothing to do and the meter readers and others would perform their duties with greater efficiency. Now it is up to you to cut down the complaint department force. Try it on, and see what can be done. This means all of you. Some time back and on several occasions, I received complaints from our complaint department, to the effect that very few complaints came from my district. This is on account of carrying out my own ideas of satisfactory service to the customer, after considerable study as to how I should succeed in selling. Now if this can be done in one section of the city, it certainly is possible for each man to supply this class of service in his own district, with the results as above outlined. Keep in touch with your customers as often as possible and see that there is no chance for a good sized "grouch" to grow in any of them. Keep them so well and satisfactorily served that they will comment on our modern methods of doing business and then, perhaps, at some near date in the future, you will be called upon (all of you) to sell those same people the company's securities; and what a delightful condition if about three-fourths of the company stock were held by its own customers.

Simplicity in Dealing

The other day a customer requested that I stop in his store and get him straightened out on a matter. A certain salesman had told him that an appliance he was trying to sell would consume so many watts under certain conditions and so many under other conditions, and this explanation was too deep for the customer. I did not mention watts, but said it will cost you so many cents per hour, etc. You must remember that the average person never hears of such terms as watts, etc., and give the information to him in dollars and cents. Be explicit and enthusiastic in your dealings with the customer and always leave him well satisfied and a good friend of the company. The fellow who "shoots off" to the customer an apparently technical line of talk, very seldom leaves with an order. It is the fellow who knows his business so well that he can present his arguments in clear, simple facts that is best able to supply the necessary satisfactory service.

General

And this "modern business method" has been employed by intelligent business houses for years. And to some extent this company has worked on "service to the customer" for quite a few years back; but this should be "prompt and satisfactory service to the customer" and a company meeting should not be held without imprinting indelibly on all employees' minds that the customer is the "boss" and that each one should see that he is promptly and satisfactorily served. This must be kept before us continually and those who do not feel that they can supply the "goods" as outlined above, had better go back to the dear old farm. They are of no use to the company or themselves in the modern business concern.

We should each insist on it—not necessarily the department heads, because under it the company is bound to grow and increase in every branch and with this prosperity we, the employees must reap the benefits

*In N. E. L. A. Bulletin

The Dealer and Contractor

Are Wiremen reading their rules carefully enough ?—Apparently a few of them are not

Mr. Strickland, chief inspector of the Hydro-electric Power Commission of Ontario, recently stated that one of the most annoying things they experience is the lack of knowledge exhibited by wiremen in some of the simplest rules in connection with wiring, which is further augmented by the evident failure on the part of some of these wiremen to read their own Rules and Regulations. "We are continually," stated Mr. Strickland, "being telephoned to by wiremen asking what the Rules say in regard to this and that and the other thing. What strikes us as so peculiar is that when wiremen have a book of rules they prefer to telephone to us and have us turn over the pages of our rule book and read the rule to them rather than take the trouble of looking through their own book. We quite expect that we will be asked to explain the meaning of certain rules upon which there may be a difference of opinion, but some of the questions which we are expected to answer consume a vast amount of time and patience and under such conditions it is very hard to refrain from saying something uncomplimentary to the person at the other end. For instance, here are a few questions which I have been asked within the last half hour, and, mind you, these are from men who have been in the wiring business for a long time:—

Q.—Do your rules allow us to use loom for bushing wires passing through joists? A.—Of course, the answer was no. See Rule E. Page 41.

Q.—What size wire will I use to supply an electric grate? A.—How many amperes does your grate consume? Q.—Don't know. A.—Ask the man who owns it. Q.—He doesn't know what kind of grate he is going to buy. A.—Then how do you expect I am going to know?

Q.—Can I supply a receptacle for a heater with No. 12 wire? A.—How many amperes does the heater consume? Q.—Ten. A.—Do you know how many amperes No. 12 wire will carry? Q.—Yes. A.—Then why do you ask me the question? Q.—Well, I just thought I would ask you.

"These are only three incidents which have occurred during the last few minutes and we frequently get such questions at, 'On what page is your rule for conduit work to be found,' and upon our inquiring if they have a book in their hand and being assured that they have, we usually tell them to look in the index, and receive the reply, 'Thanks, I never thought of that.'

"Over and above this we are confronted nearly every day with statements from wiremen like this, 'Well, I did not know there was any rule about that. I guess it will be all right this time, won't it?' and because we say that it will not be all right some of them feel mortally injured.

"I would like," continued Mr. Strickland, "to have every wireman experience what we do in this office for twenty-four hours each week, and I venture to say that a great many people in the electrical business would conclude that the electrical inspectors have a great deal to contend with and each and every one would try to do his bit by providing himself with a book of rules and then reading it. Of course, there are lots of excellent wiremen whom we are often glad to go to and from whom we often obtain valuable information, and it is only by keeping in touch with good wiring firms and up-to-date wiring journals that we are able to keep ourselves well posted."

Electrical Contractors of Brantford meet—Affiliation with provincial association left in abeyance

There was an open meeting of the Brantford Electrical Club on Tuesday evening, October 26, for the purpose of discussing a plan for affiliation of the Brantford Electrical Club with the Electrical Dealers' and Contractors' Association of Ontario. The meeting, at which the president of the Club, Mr. A. C. Lyons, was in the chair, was attended by a delegation from Toronto, including Mr. J. W. Commeford, provincial president, Mr. Geo. T. Dale, treasurer of the Toronto branch, Mr. W. H. Lodge, secretary of the Toronto branch, Mr. A. Wales, Mr. J. A. Neal, Mr. E. A. Drury and Mr. R. D. Earle, provincial secretary, also Mr. Frank Mahoney, representing the Canadian General Electric Company, and Mr. A. D. Brunskill, representing Factory Products, Limited.

After considerable discussion it was decided that the members of the Brantford Electrical Club would individually join the Electrical Dealers' and Contractors' Association of Ontario for this year and that the question of the organization of local associations throughout the province to be affiliated with the provincial association on a per capita basis would be taken up at the 1916 convention.

Considerable discussion then followed in connection with the Simcoe Hydro-electric Commission engaging in the electrical contracting business in Simcoe at the bare cost of materials and labor. Simcoe was represented at the meeting by Mr. Geo. P. Thomas and Mr. Rutherford, of Pauline & Rutherford. It was the opinion of the meeting that steps should be taken at once to present the contractors' case to the Provincial Hydro Commission, urging upon them a plan for co-operation with the dealers and contractors throughout the province, which it was felt would yield better results to the Commission, as vendors of electrical energy, than would the plan now in force in Simcoe, which tends to eliminate the contractor. It was felt that should the Commission feel that prices in certain localities for electrical work were too high, the matter should be brought to the attention of the contractors and they should be asked to justify the prices being charged or otherwise make a reduction. The contractors only desired a profit sufficient to pay overhead expense and yield a fair return on the time and capital invested in their business and with a system of healthy competition in force it was felt that the interests of the public and the Hydro Commission were thoroughly protected. After the meeting the delegates were entertained at dinner by the Brantford Electrical Club.

"Push" the Holiday Trade

It is high time the electric dealer realized that he has not been getting his fair share of Christmas gift trade. Must do more attractive advertising. Begin to lay your plans now. A few suggestions that may help the dealer to crystallize his ideas.

It is not too early for the dealer and the dealer-contractor to be thinking about the Christmas trade and his Christmas advertising.

Are you, as an electrical dealer, sufficiently seized of the fact that you **deserve** a fair percentage of the Christmas gift trade?

The public have been buying gifts for generations. Until within very recent years they were not of an electrical nature because these were not available. It follows that the "habit" of buying Christmas presents has always worked against the electrical dealer. Other lines of trade have naturally been ready to discourage any change in the buying public's habits.

The purchase of electrical gifts is thus chiefly dependent on the extent to which the public has been educated. This is the line along which our advertising must run—it must be educative.

But, before we can convince others of the value—the necessity—of electrical goods as gifts, it is necessary that we ourselves be convinced. If we **believe in** our product we can advertise it with ten-fold force. The question is, "do we really believe in it?"

"Of course," you say.

Very well then, your windows will show your confidence, your advertising will show it, your clerks will show it, your friends will show it, for they will be guided largely by your point of view.

In other words, everyone about your establishment, your office, your club, your church, your home, will be a booster for electricity—they will catch their enthusiasm—the confident tone—from you.

The writer can point you to stores in the city of Toronto where electric goods are shown you with an apologetic air, where (for example) flashlights are spoken of as toys, unreliable, and where the admission is general that electricity is expensive "of course." This attitude is not only detrimental to the trade but it is false.

Electricity—electrical appliances—can now hold their own on merit. The theories of a few years ago have been verified by practice. The electric way **is** the best way.

After all, **do** we appreciate as we ought the value of electricity in its myriad forms and its almost universal application at the coming wonderful holiday season, when human nature is at its best? **Do** we appreciate that electricity has a wonderful power and influence in **keeping** that human nature at its best the year round?

It's not too early to begin getting your plans in shape. Put your enthusiasm and belief in electricity into your windows, your letters to your patrons, your newspaper advertising. See that you radiate electric enthusiasm to your customers. See that your salesmen do the same.

As Christmas gifts electrical goods also offer exceptional opportunities to the dealer for many other reasons.

There is an almost countless variety of appliances in one form or another, applicable alike to man, woman or child, youth or maiden, to choose from.

The variety of prices places the electrical gift within

Fig. 1.—Window background suggestion Red berries, Santa Claus and windows; also black of lettering.

Fig. 2.—Window background suggestion—Red M and C, berries and candle.

the reach of all purses. Useful and coveted gifts are obtainable from a dollar up.

The reception, the welcome, accorded an electrical gift is assured by even those who do not yet appreciate its usefulness; they at least value it for its novelty and mysterious power.

And last, the electrical gift is the useful gift. It lightens our labors; adds to our hours of recreation; increases our capacity for work as well as enjoyment; enables us to live fuller lives. It is elevating in its influence on the human being, to a marked degree. So the dealer who would do the most for his fellow man will best accomplish that end by serving his own purposes—sell as many appliances as you possibly can for Christmas presents.

And how is this to be accomplished?

You must reach the public—in time.

No use tendering on a job after the contract is let, is there? Neither is there any use starting to educate people to buy electrical goods after they have purchased, or decided to purchase, elsewhere.

Plan your campaign early—launch it in good time.

How you can best reach the public depends on your locality and on local conditions—newspapers, letters, dodgers, cards, telephone calls, window displays. If you have a good stand there is nothing so effective as your windows. This suggests the wisdom of many a central station or dealer taking a prominent location for the Christmas trade—for demonstration and sale.

The demonstration idea is wonderfully effective with electrical goods. They show off to splendid advantage. It's well worth while letting goods out, in reliable homes, on trial, for a limited time—they rarely come back.

We offer herewith some suggestions for window display backgrounds. Any local artist should be able to work them out on large cardboards or on canvas. Figs. 1 and 2 will serve this purpose nicely. Fig. 3 is a suggested figure plan which the average dealer could build up with excellent results—fill out the rest of the window with various appliances. Fig. 4 represents a good "reminder" in blotter form, which could well find a place for missionary work in the office or the home. This blotter, if distributed in time, when purchasers' plans are in the formative stage, would be especially useful. Many people have the habit of sending out a number of Christmas letters, which they often write several days ahead of time so as to have that much off their minds. The use of a blotter like that shown could not fail to have its influence when the more actual work of buying gifts for local distribution begins.

Every Christmas gift giver is eagerly on the lookout for suggestions. The wise retailer will put himself about to supply them. Don't think that the buying public have all your stock in mind as you yourself have. They know nothing about it. It is your business to tell them.

It is an excellent plan to send out a brief letter with a

Fig. 3.—A good figure for an electric window.

list of suggestions—those compiled on page 39 cover the field pretty thoroughly. It helps to give the items more of a holiday flavor if you add a little border like that shown, or some color in the lettering. Such a sheet as this could very well be stamped with the dealer's name or simply signed and enclosed in "penny-saver" envelopes, which only call for a 1 cent stamp. In this way a lot of good publicity could be had at minimum cost.

Fig. 5 is a photograph of a good window display as

Fig. 4.—Suggested form an attractive Christmas blotter may take.

shown by Mr. Geo. J. Beattie at "The Electric Shop," 72 Victoria Street, Toronto, in December, 1914. Mr. Beattie makes a feature of his windows, changing them at frequent intervals—especially at seasonable dates—and finds that a very marked increase in sales follows this practice.

New Combination in Outdoor Advertising

Announcement is made of the organization of "Macey Sign Service," a new company located at 293 King Street West, Toronto, which has occasioned considerable comment in advertising circles. This firm is composed of Mr. Thos. J. Macey, and Mr. D. E. MacVannel, both of whom are experienced and widely known to the general advertising public. Mr. Macey has been a well-known figure in outdoor advertising for almost twenty-five years, and from an exceptionally wide experience, is able to offer general advertisers every service from the practical end of the business. He is senior member of the new business and will devote his energies to the development of all forms of outdoor advertising. Mr. MacVannel, who for the past four years has been advertising manager of the Russell Motor Car Company, Limited, and Canada Cycle and Motor Company, at West Toronto, is widely known among the younger generation of sales and advertising executives. His experience in selling and advertising problems will be of value to general advertisers in this connection. Among the lines covered by Macey Sign Service are electric signs of every type and design; metal, enamel and lithographed signs; in fact, every type of permanent outdoor advertising.

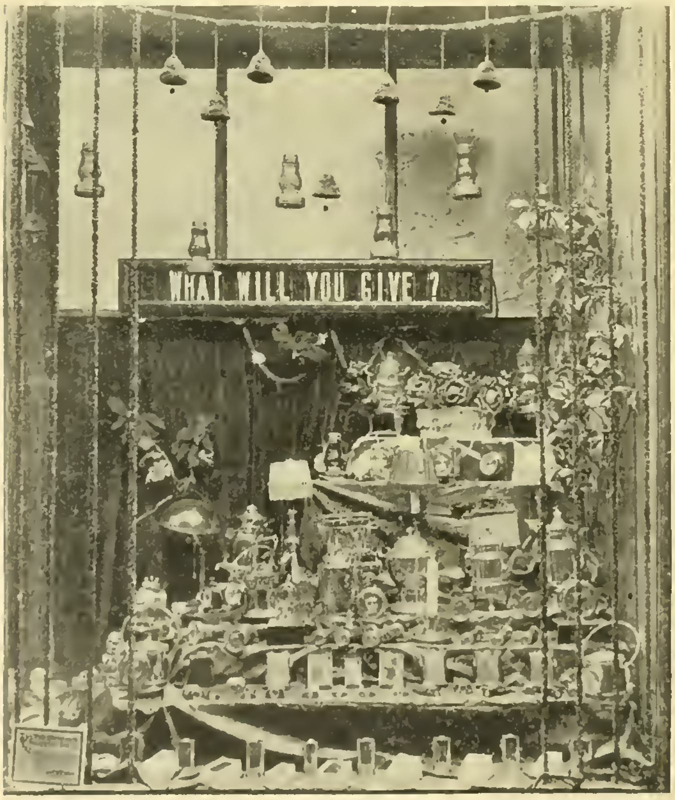


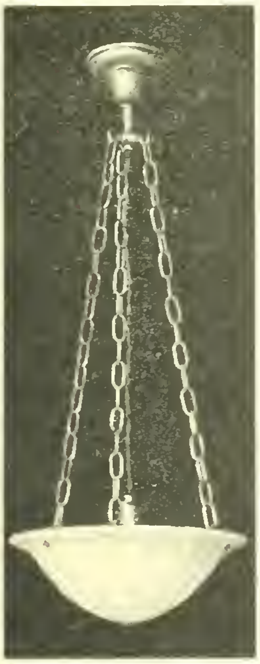
Fig. 5.—Excellent electric window display.

Hope for Fair Arrangement

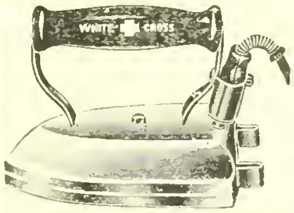
We are pleased to learn that steps have been taken in connection with the Simcoe wiring "without profit" venture, mentioned in our last issue, looking to an amicable solution of the whole matter and a just recognition of the electrical contractors of that town. The secretary of the Electrical Contractors' Association of Ontario, Mr. R. D. Earle, on Tuesday and Wednesday, November 9 and 10, met the Simcoe Branch of the Retail Merchants' Association of Canada, and we understand that decided progress was made towards arriving at what promises to be a well-balanced agreement. The suggestion made in the last issue of the Electrical News that the electrical contractors of Simcoe enter into a contract with the local Commission to do certain specified work at certain fixed prices and such as will allow the contractors a reasonable profit seems hopeful of realization. We are entirely convinced that this plan which has worked out so satisfactorily in other localities would be equally applicable to Simcoe or any other Canadian municipality.

The Fargo Manufacturing Company, Inc., of Poughkeepsie, N. Y., have opened a general sales office in New York City at 52 Vanderbilt Avenue.

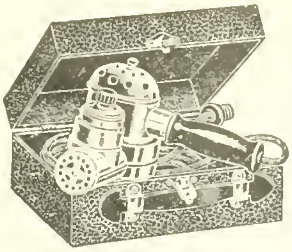
Christmas Electric Gift Suggestions



Semi-indirect—Premier Electric Co.

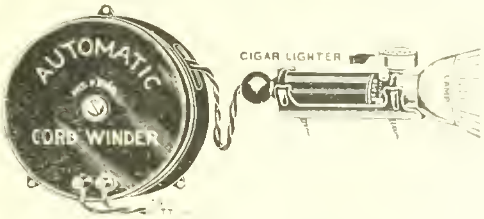


White Cross iron—Lindstrom Smith Co.

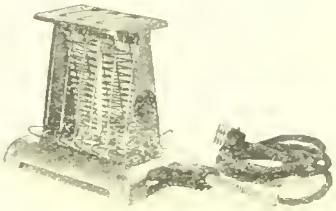


Blower and vibrator—Lindstrom Smith Co.

Iron—Northern Electric Co.



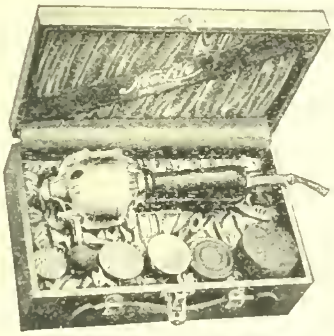
Lighter—Metal Specialties Co.



Toaster Northern Electric Co

Watchlite, a flashlight in a watch case—Bright Star Battery Co., New York.

No dust or dirt Clements Mfg. Co



Vibrator—C. G. E. Co

The Universal Cleaner—Onward Mfg. Co., Berlin.

Toy range Hughes Electric Co.

A "Code" worth following

The National Electrical Contractors' Association in the United States some time ago adopted a code of ethics to guide their members in their daily work and their relationship with one another. The Electrical Contractors' Association of Ontario will find the various sections of interest and for the most part applicable to that province and we reprint the code herewith;—

Section 1. Members of the Association shall regard themselves as being engaged in a business in which there is a well defined duty and obligation toward the public and themselves. The business demands that members use every honorable means to uphold the dignity and honor of this vocation, to exalt its standards and to extend its spirit of usefulness.

Section 2. Every member of this Association should be mindful of the public welfare and should participate in those movements for public betterment in which his special training and experience qualify him to act. He should not, even under the client's instruction, engage in or encourage any practices contrary to the Rules and Regulations Safeguarding Life and Property, for as he is not obliged to accept a given piece of work, he cannot, by urging that he has followed his client's instruction, escape the condemnation attaching to his act. Every member of this Association should support all public officials and others who have charge of enforcing safe regulations in the rightful performance of their duty. He should carefully comply with all the laws and regulations touching his vocation, and if any such appear to him unwise or unfair, he should endeavor to have them altered.

Section 3. It is unbusinesslike for a member of this Association to assist unqualified persons to evade or to lend himself in the evasion of any of the recognized rules and regulations governing electrical work.

Section 4. Members of this Association should expose, without fear or favor, corrupt or dishonest conduct and practices of the members of their business, and it is their duty to bring to the attention of the proper authorities the existence of electrical conditions which are unsafe to life and property.

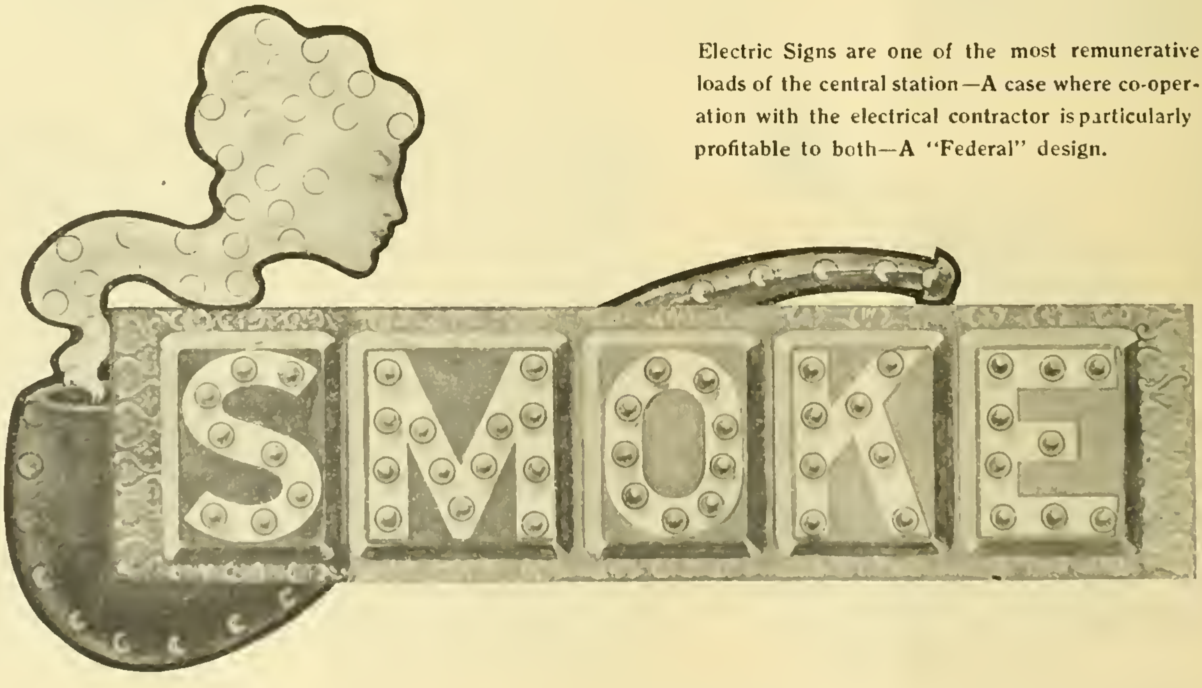
Section 5. Members of this Association owe a duty to the business of refusing to furnish estimates to general contractors who do not regard bids as final and binding upon which they are awarded general contracts.

Section 6. Members of this Association shall not falsely or maliciously injure, directly or indirectly, the business reputation, prospects or business of a fellow member of this Association.

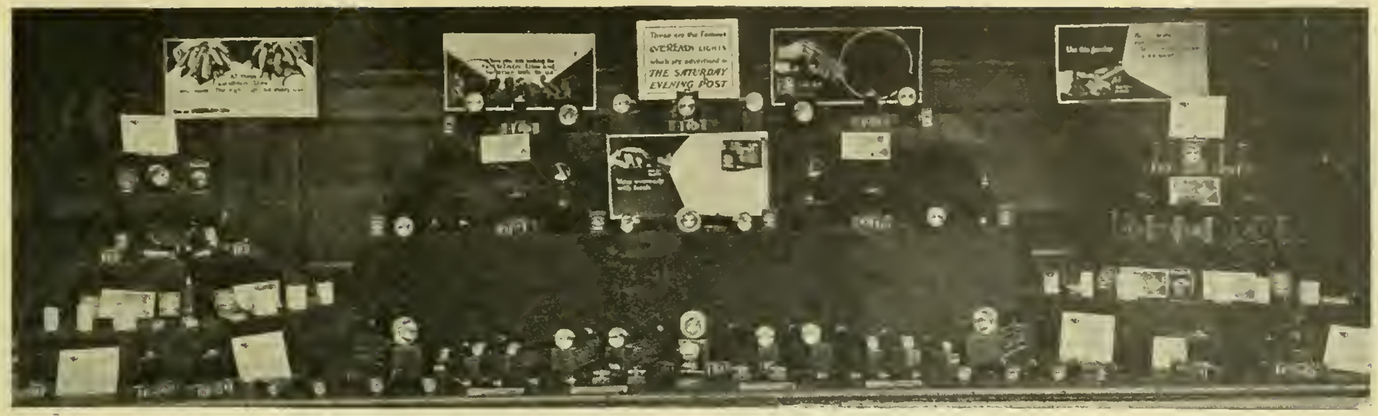
Section 7. Members of this Association shall not attempt to supplant a fellow member after definite steps have been taken toward his employment or toward the letting of a contract to him. Nor should they offer any interference in the carrying out of said contract or commission to the end that loss or damage may result to the fellow member.

Section 8. Whenever disputes or differences arise between members, it should be the duty of the parties to the controversy to submit the trouble to an arbitration of two disinterested members of this Association, and in the event of a failure to arrive at a satisfactory settlement, then, upon request, the President of the National Association shall appoint a third member of the Commission and the decision of the majority of said Commission shall be final and binding.

Work your windows steadily. Change their dress frequently, daily if need be, and change it so materially that they cannot be recognized. Keep constantly changing their appearance, so as to make them attract, and do not lose that big percentage of passersby who, having once become accustomed to your display, never give it a second glance, even though it be months afterwards. Make people go out of their way to see your window. Make them expect changes and then do not disappoint them. Work your window hard and persistently, but don't overwork it by crowding your displays.



Electric Signs are one of the most remunerative loads of the central station—A case where co-operation with the electrical contractor is particularly profitable to both—A "Federal" design.



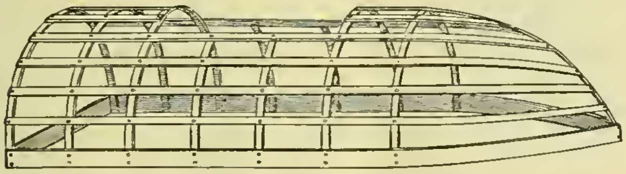
Attractive window display of "Eveready" flash lamps and lanterns.

A Unique Float

The accompanying illustration shows a float that was generally conceded to be among the best of the 117 that participated in the recent parade held by the business men of Liberty, N. Y. The float, which was built and entered by Mr. R. M. Sloan, Superintendent of the Liberty Light & Power Company, was a representation of a Westinghouse Type E electric iron. Following the business men's parade, the Firemen of Liberty held a parade and the "Iron" float was selected for participation therein as one of the best decorated in the previous event. Realizing the advertising advantage to be gained by his company from a continued exhibition of the float, Mr. Sloan has mounted it on the roof of his power house, where it can be seen from all parts of the city. The details and cost of construction of the float are given for the benefit of those who may have occasion to build a similar one.

The framework is made of ½ inch strips of lumber, over which muslin is tightly stretched; sufficient padding is placed on the inside of the frame to prevent scratching the car. The muslin is then well coated with alabastine and when dry a coating of aluminum bronze is applied. The cord is made from 4-inch fire hose and the plug receptacle was cut from a "cheese box." The iron completely covers the car and the whole outfit measures over all 16½ feet long by 7 feet wide by 9½ feet high. The entire iron was constructed and then placed over the body of the machine. The detailed expense is as follows:

5 pounds alabastine	$ .30
3 small cans black paint	.49
3 cans aluminum bronze	3.00
1½ gal. bronze liquid	3.75
8 yards of muslin	.64
Labor, lumber and carpenter work	20.50
Lettering	2.50
	$31.18



Frame for building up float.

Central station advertising electric irons.

Successful Convention

The annual sales convention of the Robbins & Myers Company was held at Springfield, October 20th, 21st and 22nd. The mornings were devoted to the general discussions. Wednesday morning was devoted to a discussion on fan sales and the meeting was presided over by W. W. Mumma, fan sales manager. Thursday morning, first session was devoted to a discussion on motor sales, conducted by Eugene Newnham, motor sales manager and supervising engineer. The second session was devoted to a discussion on advertising, led by C. H. Clark, advertising manager. Friday morning was devoted to a discussion on credits and collections and the meeting was presided over by C. C. Miner, auditor. Wednesday and Thursday afternoons were allotted for individual conferences between the branch offices and the various departments of the home office. A schedule was given each of the visitors showing him the hour allotted him for his visit with the motor sales, fan sales, advertising, engineering and credit departments. Friday noon the real business of the convention was brought to a close and all of the delegates were loaded in two of the company's trucks and taken to the log cabin of W. A. Myers, secretary of the company, where they were entertained to a buffet lunch and the afternoon was given over to a general good time and get together meeting.

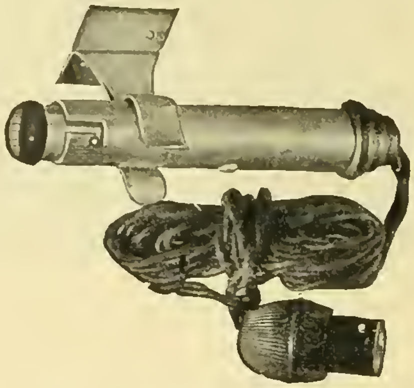
Trade Publications

Ammeters and Voltmeters—Leaflet by Roller-Smith Company, 203 Broadway, New York, describing "Junior Imps"—small, direct current ammeters and voltmeters for battery charging outfits, small switchboards and similar applications.

Air Heaters and Blowers—Bulletin 219, by the B. F. Sturtevant Company, describing, with illustrations, their new combined electric blower and heater.

Christmas Electric Gift Suggestions

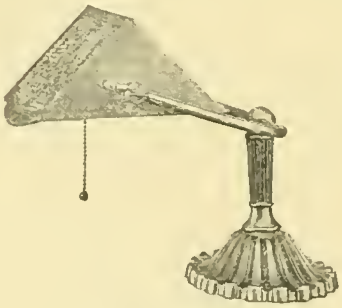

Table lamp—McDonald & Willson, Toronto.

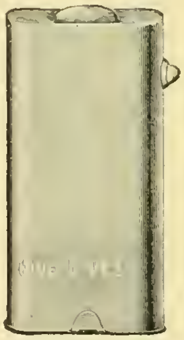

Lighter—Premier Electric Co., Montreal

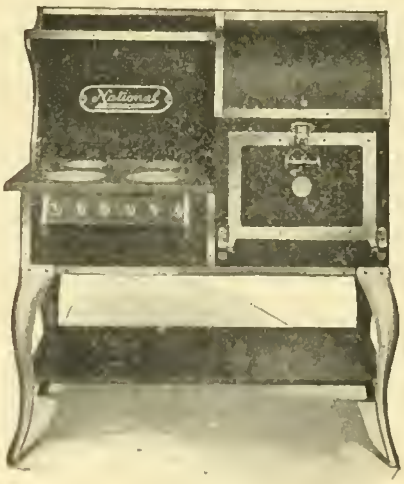

Toy stove—Western Electric Co., New York.


Cane flash—Premier Electric Co.


Two-disc electric—National Electric Heating Co.


Study or piano lamp—Canadian General Electric Co.

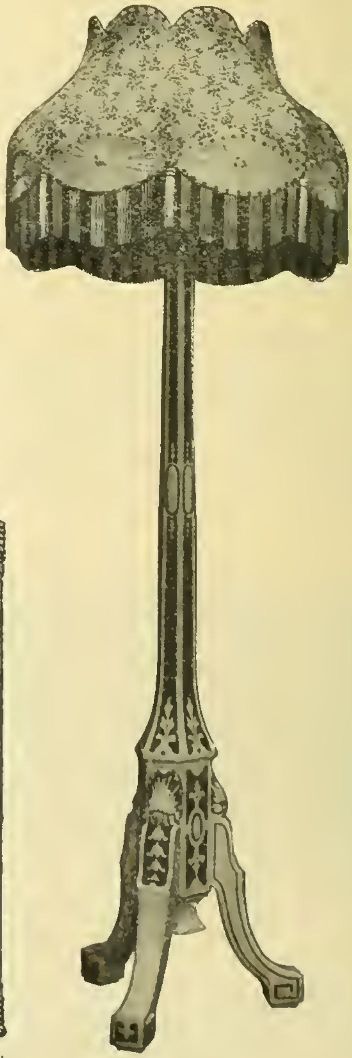

Pocket flash—Premier Electric Co.



Electric range National Electric Heating Co.


Searchlight Toilet Mirror—Federal Sign System (Electric) Toronto

Torch Canadian Carbon Co.


Parlor or living room lamp—National X-Ray Reflector Co.

Christmas is near— What will you give?

Everybody appreciates the electrical gift—Everybody finds it useful—Everybody who gets one this year will be happier in 1916. Why not your own friends? Here are a few suggestions:

For Children

Baby dynamo
Battery
Battery lantern
Bicycle lamp
Christmas tree lighting outfit
Corn popper
Dark room lantern
Electric aeroplane
Electric engine
Electric questioner
Electric scarf pin
Electric top
Electrically operated boat
Flashlight lamp
Flashlight pencil
Fountain pen flashlight
Hand lamp
Lantern attachment (battery)
Low voltage lamp
Low voltage transformer
Mechanical toys (motor operated)
Merry-go-round
Miniature static machine
Optical illusion box
Permanent magnet
Picture projector
Shock coil
Smoothing glass
Spark coil
Telegraph instrument
Telephone bank
Toy aeroplane
Toy automobile
Toy fan
Toy magneto
Toy motor
Toy railway outfit
Toy electric range
Toy telephone outfit
Toy trolley car
Toy X-ray outfit
Water power plant
Wireless outfits

For Men

Alarm clock
Auto battery lamp or lantern
Auto foot warmer
Auto engine warmer
Auto heated grips
Auto searchlight
Auto trouble lamp
Auto wind shield cleaner
Battery lantern
Bed lamp
Bicycle lamp
Chair lamp
Chest of automatic lamps
Cigar lighter
Drink mixer
Electric horn
Electric scarf pin
Electric watch charm
Flashlight cane
Floor portable
Flashlight umbrella
Foot warmer
Hair singe
Hand lamp
Illuminated mirror
Instrument sterilizer
Lantern attachment (battery)
Pistol flashlight
Pocket testing meter
Reminder clock
Shaving mirror
Silk hat iron
Table or reading lamp
Traveler's lamp
Traveling iron
Traveling stove
Vest pocket flashlight
Vibrator

For Women

Air heater
Automobile (electric)
Battery candle
Battery lantern
Beauty lamp
Bed and boudoir lamp
Broiler
Bungalow portable lamp
Casserole
Cereal cooker
Chafing dish
Coffee pot
Coffee urn
Curling iron
Cosmetic heater
Curling iron heater
Dish washer
Disc stove
Egg boiler
Egg beater
Electric comb
Electrically lighted table clock
Electric fan
Electric range
Fireless Cooker
Flat iron
Flashlight lamp
Floral decorations
Foot warmer
Grid
Griddle
Grill
Hair dryer
Hair singe
Heating rod
Home ironing machine
Illuminated mirror
Heating pad
Illuminated table ornament
Immersion heater
Indirect lighting portable
Limousine telephone set
Massage vibrator
Mission portable
Ozonator
Percolator
Piano lamp
Plate warmer
Radiator
Reading lamp
Samovar
Saute pan
Sewing machine motor
Smoothing glass
Teakettle
Toaster
Toaster-stove
Toaster-stove and griddle
Traveling iron
Traveling stove
Utility motor
Vacuum cleaner
Waffle iron
Washing machine
Water cup
Water heater
Writing desk lamp

For Older People

Battery candle
Bed lamp
Ceiling clock
Egg cooker
Electric bath cabinet
Foot warmer
Hearing devices
Heating pad
Immersion heater
Medical battery
Medical coil
Milk bottle or food warmer
Nurse signal
Ozonator
Ozone blanket
Perfumer and disinfector
Radiator
Regulating socket
Sterilizer
Toaster
Toaster-stove
Vaporizer
Ventilating fan
Vibrator
Water heater

What is New in Electrical Equipment?

Better Switch and Bus Equipments

By E. O. Sessions

Delays and outages due to short circuits and switching mistakes have ever been serious, but with increasing sizes in generation units the significance of better equipment in switches and bus supports is very apparent to anyone. We now have units of 20,000, 25,000, 30,000 and 35,000 kw. with 50,000 units already designed, and engineers are to-day demanding better switches with guaranteed minimum millivolt drop under full load, fixed frequency and temperature; such switches can only be manufactured with special care, and materials. The use of solid copper forgings has made possible great savings in energy formerly lost through use of poor design and cast copper parts in switch construction. Another waste in energy is found in the various clamp devices that are used on the buses, supporting cables, etc. The elimination of this waste can be obtained by the use of non-magnetic materials in the construction of the clamping member or the supporting device of the conductors. Phosphor bronze bolts, when machined from solid rod, have great strength and are superior to brass or other metals. The porcelain factor is one often neglected by the designing engineer, primarily owing to a multitude of other details seemingly of more importance. It may almost be said that the entire system is dependent upon the insulating properties and strength of the station porcelain, whether this be on switches or on bus supports. Porcelain manufactured by the

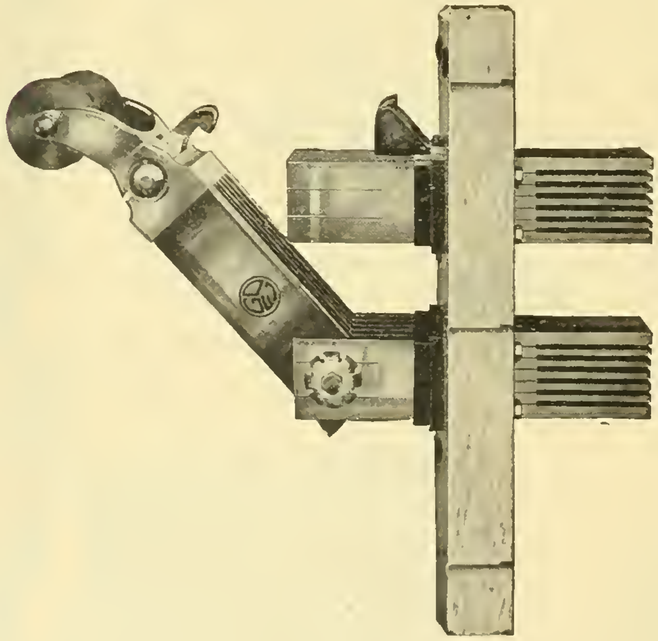


Fig. 1

wet process has greater strength than that of any other process and is, therefore, used exclusively for all classes of important devices and fittings. Such porcelain can be equipped with well cushioned mechanical clamps for the proper support of its hardware. The use of cement in any form should be avoided. The design should permit a test with combined high frequency and high potential of, say, 4 to 7½ times greater than the service voltage, and on high capacity service due allowance must be made for "spill over" troubles. This usually requires very heavy and rugged porcelain.

The General Devices & Fittings Company have recently furnished much switch and bus support equipment for three of the largest power plants on the continent, and a description of a few of these new designs are shown here for the first time. Fig. 1 shows side view of a back connected positive lock type switch with a rating on 680 and 68 basis of

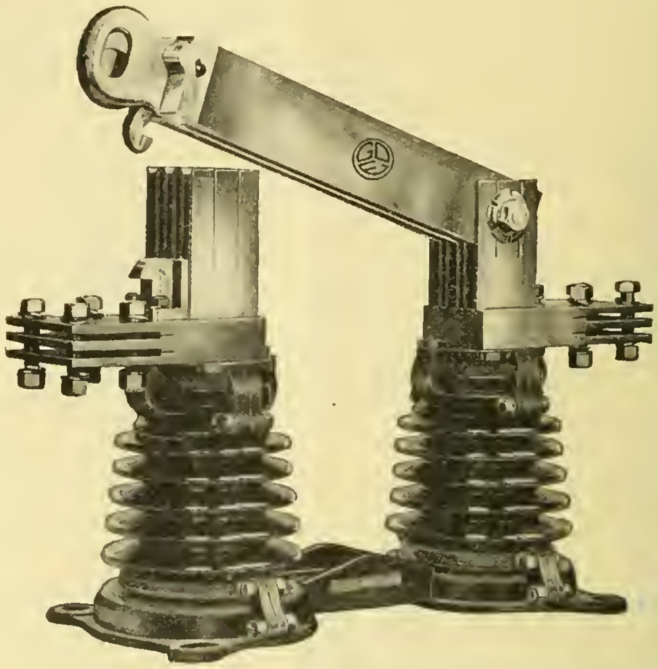


Fig. 2

6,000 amperes and 600 volts, 60 cycles and 20 degrees F. limit rise. These are the only switches ever provided with a positive lock which is thrown in or out with the switch handle. The studs are milled from solid copper forgings and slotted 7 inches deep for bus insertions. The studs can also be

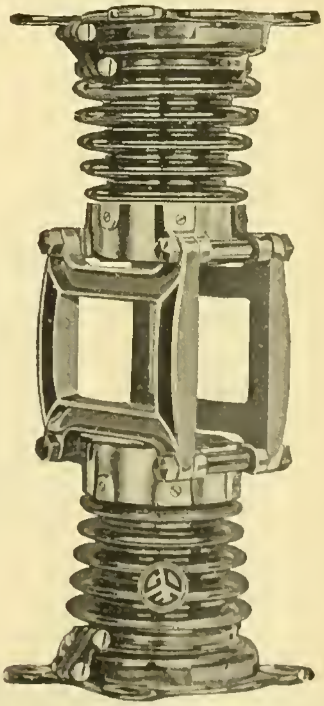


Fig. 3

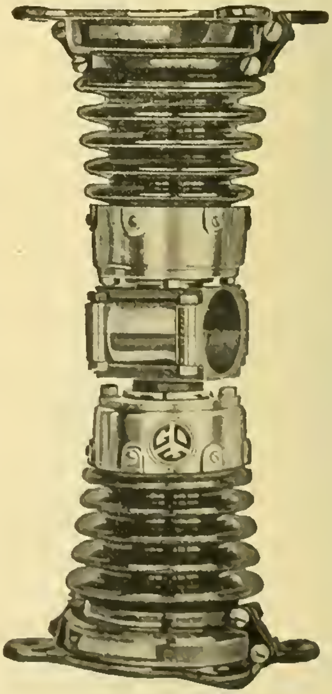


Fig. 4

slotted for vertical buses. All contacts are ground to reduce the millivolt drop to lowest possible point. All hardware, bolts, nuts, spring washers, etc., are of phosphor bronze, turned from solid rod. The clips are of Sigamond spring copper; the blades are extra hard drawn pure blading copper; the handle fork and entire lock are of Hertz non-magnetic metal; and the handle itself is of black fibre made from rings turned to sizes and treated. This switch is made in sizes up to 16,000 amperes; above 10,000 amperes all sizes are equipped with double cushion locks and interferences.

Fig. 2 shows a special generator bus switch rated at 2,000 amperes and 15,000 volts, and mounted on a patented malleable iron bridge base. The positive type lock is especially heavy and very rugged. The clip block is a single piece copper forging, slots 6 inches deep. Fig. 3 shows a 15,000 volt special extra heavy clamp type bus support for holding heavy vertical buses and arranged to be mounted in and between a 36-in. compartment. Fig. 4 is also special and extra heavy. It is arranged for 3½ in. copper tubing insulated for 13,200 volts. It is adjustable all around, and can

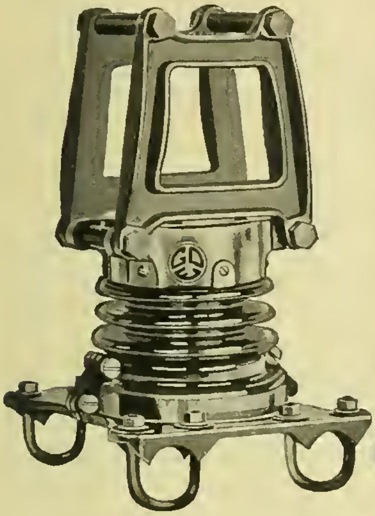


Fig. 5

Fig. 6

be removed from the bus with power on bus. Fig. 5 shows a single support to take one phase leg from the main support. It is arranged for mounting on two parallel pipes and is built to clamp the bus and not for contact. Fig. 6 shows a heavy contact type bus support for 15,000 volt service. This support is adjustable all around. All porcelain is tested with high frequency at 220 to 280,000 cycles and is also given a combined high potential 60 cycle and high frequency test of 275,000 cycles before shipping, and this test is with all hardware and equipment in place. All shipments are packed in cartons, each unit complete.

This was the first company to build switches with a guaranteed millivolt drop, and on both the "heavy capacity" and the "central station" standards. Copper forgings are used entirely for all switch work and terminals. The porcelain used has no equal for design or strength, and is guaranteed to be wet process entirely. Corrugated "Post" type for voltages up to 66,000 are stocked. Floor and wall tubes and bushings are also stocked up to 35,000 volts and can be furnished up to 150,000 volts. Their exhibit of porcelain is the largest in the country, and in fact, anywhere outside of an insulator factory. The trade mark "G.D.F." means "Good Designs First," and, taken with the slogan of "Quality and Service" are exemplified through the electros herein shown.

Hangers for Conduit and Open Wiring

Several types of girder clamps and conduit clips have been developed by the Thomas Wrigley Company, of 416 South Dearborn Street, Chicago, to facilitate the work of suspending electric lines from steel beams. The clamps are made adjustable so that they will fit beams ranging in width from 2 inches to 7 inches. As indicated by the dotted line

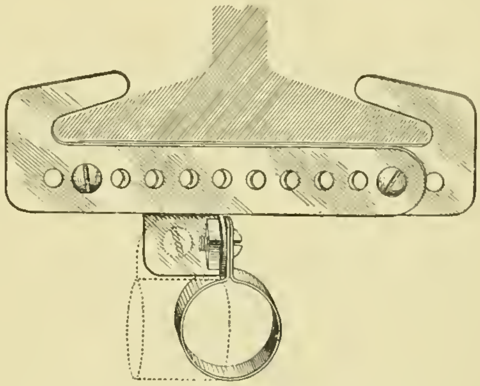


Fig. 1—Conduit Clamp attached to I-Beam

in Fig. 1, the clip can be used for conduit runs which are either parallel to or at right angles with the length of the girder.

If the clamps are to be used for supporting wires, they are furnished equipped with a metal cross-arm to which

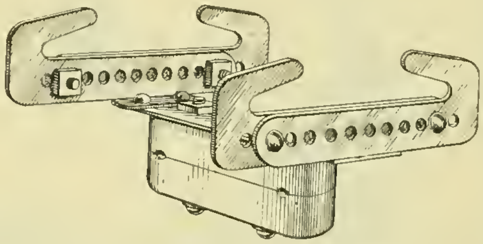


Fig. 2—Clamp used with Cleat Construction

cleats are attached. Where many lines are to be strung parallel to each other the metal cross-arms are made of sufficient length to carry the entire number of necessary porcelain cleats.

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200 Watt Nitrogen Reflector

The 200-watt gas-filled tungsten lamp, when equipped with an efficient and broadly distributing reflector, gives general lighting of ample intensity for ordinary manufacturing operations in 20 x 20-foot bay, or unit area. This means good lighting is obtainable for an energy consumption of 0.5 watts

per square foot. The new X-Ray No. 575 silvered mirror reflector, shown herewith, has been developed for use with this lamp. It is of the Beehive type, gives a broad distribution of light and effectively conceals the lamp from direct view along the ordinary line of vision. It gives a remarkably uniform illumination on the working plane. The dual

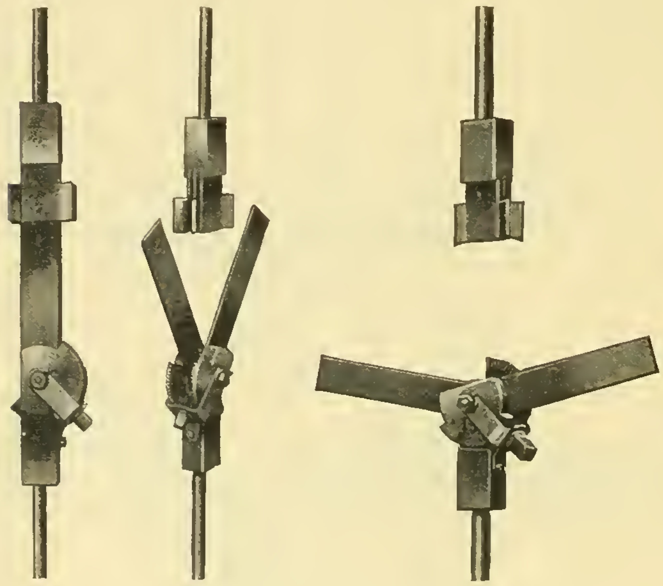
system of corrugations shown on the illustration effectively breaks up the light from the concentrated filament of the 200-watt lamp, eliminating images of the filament, streaks and striae in the illuminated field.

This reflector may also be used with the 150-watt vacuum lamp. With this lamp the light distribution is practically the same as that secured with the 200-watt lamp, except that the candle power values are correspondingly lower.

This reflector is the first of a complete line of industrial lighting reflectors for all sizes of gas-filled lamps, which this company contemplates placing on the market in the near future.

A Disconnecting Switch with Torsional-Balanced Blade

A simple disconnecting switch designed to economize in the matter of insulators, copper, framing and space is shown in different positions in the accompanying illustration, as made by the Minerallac Electric Company, 400 South Hoyne Avenue, Chicago, Ill. The switch proper consists of two blades that move in opposite directions. When closing the



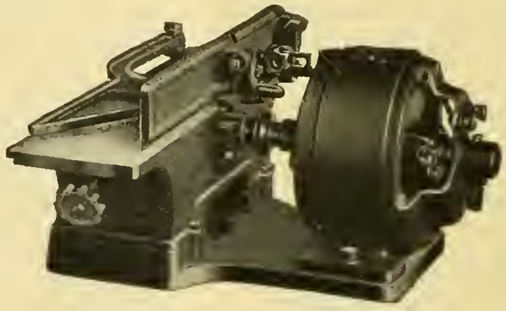
usual knife disconnecting switch, there is a thrust, which necessitates a support to receive it. On account of the torsional-balanced blades in the switch shown, however, no support is required. By doing away with insulators, leakage of course is eliminated. The switch is operated by a handle and is automatically locked in any position. It can be operated, it is said, in a closed compartment through a 1-in. hole. The self-locking feature is obtained by means of geared construction.

Canada Sales Co. New Offices

The Canada Sales Company have removed their salesroom to 165 Church Street, Toronto, phone Main 4219, where they have a bright attractive showroom for the convenience of the trade. Electric fixtures and bowls are illuminated. Dealers are at liberty to bring their customers in and sell them from the samples. A branch office and showroom will be opened in Montreal shortly.

New Electric Bench Jointer

The Crescent Machine Company, Leetonia, Ohio, have developed a small four-inch electric jointer to do such jobs as are ordinarily done by hand with a plane and square. The machine is furnished with a round safety head, tilting fence for level work, automatic guard and rear table for rabbetting. The jointer and motor are direct connected and are mounted on a common sub-base. The knives are four inches long and the over-all dimensions of the machine are 20 in. x 18 in. x 9 in. high. The net weight is 90 pounds. In one opera-



tion this machine will do the same work that requires a number of operations when done with a plane and square. The motor has an output of ¼ horse-power; it is manufactured by The Robbins & Myers Company, Springfield, Ohio.

Electrically Operated Rubbing and Polishing Machine

One of the important elements in the cost of any piece of furniture is the finish and polish given to it. In the older methods where polishing was done by hand this involved very tedious and costly work. A number of pneumatically operated rubbing and polishing machines have been developed, but many of these are very noisy in operation and entail considerable investment because of the necessary air compressor equipment. An electrically-driven machine for this purpose has recently been developed for this purpose which is believed to be a marked advance. As shown in the illustration, it is a completely enclosed compact outfit connected by flexible cord to any lighting outlet. It contains

a one-quarter horsepower motor controlled by a simple snap switch. This motor is connected by suitable mechanical means so as to oscillate the two pads on the bottom of the machine. These felt pads are 5½ x 4½ inches in area and are given an oscillating motion 400 times per minute in the direction of the longer dimension of the machine. These pads can be readily removed in a few seconds by the pressure of a finger. To this can be affixed sandpaper or other grinding or rubbing surfaces. This machine is being sold through Bagge's Export Combine, 53 West Jackson Boulevard, Chicago, Ill.

A Durable Receptacle

Owing to the fragility of porcelain it is not adapted to the rough usage experienced in many industrial plants, and the use of composition electrical appliances is constantly increasing in this field because of their durability. Harvey Hubbell, Inc., have recently placed on the market a com-

bination current tap and lamp receptacle made of a tough heat proof composition, capable of withstanding hard usage. While this device was primarily designed to meet industrial conditions, it is equally adapted to household uses. It is fitted with standard contacts and is interchangeable with the complete line of Hubbell T-slot wall and flush receptacles.

Personal

Mr. W. H. Stapleton is acting superintendent of the Niagara, Welland and Lake Erie Railway, Welland, Ont., during the illness of the superintendent, Mr. F. J. Boyd.

Mr. W. Norris, formerly general manager, chief engineer and purchasing agent of the Chatham, Wallaceburg and Lake Erie Electric Railway Company, has been appointed general superintendent of that road. Mr. A. C. Johnstone has been appointed accountant, and Mr. L. W. Mitchell, Toronto, treasurer and purchasing agent of the C. N. R., has also been appointed purchasing agent of the C. W. & L. E.

Mr. Geo. L. Guy has been appointed consulting electrical engineer to the Public Utilities Commission of the province of Manitoba, which is in the process of re-construction.

Mr. Walker, who superintended the changing of the entire electric system of the town of Newmarket, is now in charge of the Metropolitan electrical sub-station on Queen Street, Newmarket.

Mr. L. C. Fritch has been appointed general manager of the Chatham, Wallaceburg and Lake Erie Railway System. Mr. Fritch was formerly general manager of the C. N. R. eastern lines, and will now occupy the dual position.

Obituary

Col. D. C. Cameron of Quebec, formerly a director of the Quebec Railway, Light, Heat and Power Company, is dead.

W. H. Nix, for many years head roadmaster of the Toronto Railway Company's system, died in Wellesley Hospital on October 14th.

Mr. C. B. Hunt, one of London's best known citizens and familiar to electrical men all over the Dominion through his intimate connection with the London Electric Company, is dead.

Current News and Notes

Balgonie, Sask.

The Balgonie Rural Telephone Company are proceeding with the erection of a quantity of poles, total extensions to cost $9,500.

Bay of Islands, Nfld.

Jos. Salters & Sons, Commercial Street, North Sydney, C. B., have made application for permission to develop water powers near Bay of Islands, Nfld.

Beausejour, Man.

The Town of Beausejour has decided to take over the transmission line between Saldo and Beausejour, owned by the city of Winnipeg, at a cost of $7,500. A by-law has been passed by the town, providing for an appropriation of $15,000 for the purpose of acquiring the line and installing an electric lighting system here.

Calgary, Alta.

R. S. Kelsch, consulting engineer, Montreal, is reported as stating that "there is no other city in Canada the size of Calgary that can compare with it in the excellent arrangement of its power and light; in the equipment of the plant and sub-stations and in the efficient arrangements for distribution, as well as in the business management."

Chapleau, Ont.

The corporation of the township of Chapleau are submitting a by-law to the electors on November 15th authorizing a ten-year franchise agreement with the Chapleau Electric Light and Power Company.

Fort William, Ont.

At the recent meeting of the utilities committee, the manager's report for October showed a gain of 24 telephone subscribers and of 29 light consumers. The net loss on the electric railway for October was $5,308.13.

Guelph, Ont.

The Bell Telephone Company are erecting a new exchange at Guelph and will cut in the service about the 15th of December.

Kaslo, B. C.

The British Columbia Telephone Company have purchased a property in Kaslo on which to locate their new exchange building.

Kingston, Ont.

The Utilities Commission of Kingston have finally accepted the offer of the Gananoque Light and Water Supply Company to use their surplus power delivered at 2,300 volts, the cost to be three-quarter cents per kw.h. Mr. Campbell, president of the company, reserves the right to utilize up to 200 h.p. for his own purposes.

Dissatisfaction with the way the new rates are working out in the city of Kingston is being freely expressed by the consumers. It is evident that the system of charging is not entirely suitable for existing conditions in that city. Within the last few days a new offer has been made to the city by Mr. B. R. Newton, of Arden, who claims to have a water power some fifty miles from Kingston capable of developing 2,000 horsepower with a minimum of 1,000 horsepower. Mr. Newton offers to sell this water power to the city, retaining only such small portion of it as would be required to drive his own mills.

Le Pas, Man.

A by-law will be submitted at the municipal elections at

the end of the year to raise $12,000 for the construction of a municipal telephone system.

Certain water powers in the vicinity of Le Pas are being investigated, and it is believed that Lynx Falls, near Setting Lake, some 100 miles from the town, may prove the most satisfactory source of supply.

Levis, Que.

The Bell Telephone Company, which some time ago acquired the property of the National Telephone Company at Levis, St. Romuald and Chandiere, is now in possession.

London, Ont.

The Public Utilities Commission, London, Ont., are contemplating the installation of an ornamental lighting system in Market Square, to cost $2,700.

Montreal, Que.

Mr. John Sise, the general manager of the Bell Telephone Company, announces that the company are taking steps to reduce the cost of the service in the Montreal outlying districts.

The Eugene F. Phillips Electrical Works, Limited, Montreal, have received a contract from the Shawinigan Water and Power Company for 2,500 feet of 500,000 c.m. 3 conductor 12,000 volt paper insulated, lead covered and armoured submarine cable. The cable will be laid in the St. Charles River, Quebec.

Niagara Falls, Ont.

The by-law submitted on November 4 authorizing a contract with the Hydro-electric Power Commission of Ontario for a supply of power was carried. Debentures to the amount of some $14,000 will be issued to purchase sub-station and distribution equipment.

Ottawa, Ont.

The Diaphone Signal Company has been incorporated with head office at Toronto and capital of $825,000.

Otterville, Ont.

A by-law was submitted on November 5th to the ratepayers of Otterville, Ont., authorizing a contract with the Hydro-electric Power Commission.

Renfrew, Ont.

The town council has passed a resolution authorizing the power development committee of the council to take up the matter, with the Hydro-electric Power Commission of Ontario, of obtaining a power supply from the Madawaska River or some other suitable source. It is believed that one of the town's customers, the Munitions Company, may next year require as much as 2,000 h.p.

Rossland, B.C.

For the year ending August 31 last the gross earnings of the West Kootenay Power and Light Company totalled $388,193, and the operating expenses $106,296, leaving a balance of $281,896, a decrease of $13,421. This enabled the company to pay its fixed charges, dividends on the preferred and common stocks and add to the profit and loss account the sum of $29,578, leaving that account at the 31st of August, 1915, at $331,640. The following officers and directors were re-elected at a meeting held in Montreal on November 6: President, Mr. Chas. R. Hosmer; vice-president and general manager, Mr. L. A. Campbell; directors, Messrs. Frank Paul, Geo. F. Benson, W. J. Shaughnessy, Walter R. Baker, C.V.O., and Edwin Hanson; secretary-treasurer, Mr. F. E McNally.

Sarnia, Ont.

The city council of Sarnia, Ont., have decided to submit a by-law to the people at the January elections authorizing a contract with the Hydro-electric Power Commission.

Sherbrooke, Que.

Considerable trouble developed recently at the Lake Magog power dam, maintained jointly by the power interests in the vicinity of Sherbrooke. As a result of the uncertainty which this condition has produced it is suggested that power be brought in from the lines of the Shawinigan Water and Power Company, which already reach to Windsor Mills.

Southampton, Ont.

Estimates will be secured from the Hydro Commission on the cost of installing a distribution system in Southampton, Ont.

Sudbury, Ont.

The town council, Sudbury, Ont., are contemplating the installation of a lighting system to light the Sudbury-Copper-Cliff Road, about ten miles in length. Lamps would be suspended from the poles of the Sudbury-Copper Cliff Suburban Electric Railway Company.

Toronto, Ont.

By-laws will probably be submitted at the year-end elections throughout the municipalities interested in a hydroelectric radial road between Toronto and Sarnia. It has been suggested that the present Toronto to Guelph road, on which considerable construction work has been done by C. N. R. interests, may be taken over, and Sir Adam Beck is quoted as saying that this question will have been settled before the end of this year.

Vancouver, B.C.

Mr. R. F. Hayward, manager of the Western Canada Power Company, recently delivered an illustrated lecture before the Vancouver branch of the Canadian Society of Civil Engineers on the Mexican Light and Power Company's plant.

Condensed Department

Publisher's Notice

Advertisements under "Situation Wanted" or "Situation Vacant" are charged at two cents a word per insertion, minimum charge 50 cents.

Advertisements for tenders, equipment, wanted or for sale, etc., or miscellaneous, are charged at $2.10 per inch.

All advertisements must be in the publisher's hands by the 10th or 23rd of the month to insure insertion in the subsequent issue.

The Public Utility and the Press

Discussing relations with the press, the public and municipalities, in a recent address before the Norfolk (Va.) Rotary Club, Mr. E. C. Hathaway, assistant general manager of the Virginia Railway and Power Company, remarked that the public service corporations are the only clients of the press who pay their good money for advertising space and at the same time are criticised unmercifully by men whose knowledge of the business criticised is on a par with their familiarity with Hebrew or Sanskrit. Paraphrasing Lincoln's saying, Mr. Hathaway added: "You can please all of the people part of the time, but you cannot please all of the people all of the time." Public service companies are business ventures, selling public necessities that enter into our daily life. As they are always before the people, criticism is natural. It is unfortunate that in the majority of cases the stock in these companies is not held locally; theoretically it should be held in the cities in which they operate. In the majority of cases electric railways, lighting plants and gas companies were originally local concerns and were only fairly successful at first. The rapid growth of the towns in which they operated made large expenditures necessary for extensions, betterments and improvements. The financing could not be done locally, and as a result the stockholders sold out, usually at good profits, to syndicates that had the money-raising ability.

On the subject of what the corporations owe the public, Mr. Hathaway said that the obligation is clear. They owe the best possible service that can be given, consistent with a fair return on the capital invested, plus the proper up-keep of the property. Proper up-keep means the adoption of every modern device and improvement which makes for economy both to consumer, the constant supervision of delivery to insure satisfaction, and proper hearing and attention for all just complaints. Education and thought are doing for the companies what they could not do for themselves; therefore it behooves them to help this education by getting out into the open and telling the people what they are doing, what they are trying to do, and what they expect to do in the future.—N. E. L. A. Bulletin.

Lighting Schedule December, 1915

Courtesy of the National Carbon Company Cleveland.

Date	Light	Date	Extinguish	No. of Hours
Dec. 1	5 00	Dec. 2	3 30	10 30
2	5 00	3	4 50	11 50
3	5 00	4	6 00	13 00
4	5 00	5	6 30	13 30
5	5 00	6	6 30	13 30
6	5 00	7	6 30	13 30
7	5 00	8	6 30	13 30
8	5 00	9	6 30	13 30
9	5 00	10	6 30	13 30
10	5 00	11	6 30	13 30
11	5 00	12	6 30	13 30
12	10 10	13	6 30	8 20
13	11 10	14	6 30	7 20
15	0 10	15	6 30	6 20
16	1 20	16	6 40	5 20
17	2 20	17	6 40	1 20
18	3 20	18	6 40	3 20
19	4 20	19	6 40	2 20
20	No Light	20	No Light	
21	No Light	21	No Light	
22	5 00	22	7 00	2 00
23	5 00	23	8 00	3 00
24	5 00	24	9 10	4 10
25	5 10	25	10 10	5 00
26	5 10	26	11 10	6 00
27	5 10	28	0 10	7 00
28	5 10	29	1 20	8 10
29	5 10	30	2 30	9 20
30	5 10	31	3 40	10 30
31	5 10	Jan. 1	4 40	11 30

Total Hours 217.20

Electrical News
Generation, Transmission and Application of Electricity

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Fixation of Atmospheric Nitrogen

It has been said that our civilization is almost entirely dependent on the first four to six inches of soil covering the surface of the earth. The importance of a proper fertilization is thus self-evident. The three most important ingredients of fertilizers are phosphorus, potassium, and nitrogen—the latter probably the most important of all. Unfortunately, plant life of every sort deprives the soil of these ingredients, and it is necessary, therefore, if we would preserve our civilization and advance it, that these ingredients be replaced systematically, and, of course, as cheaply as possible. The demand for fertilizer has of late years materially increased, as the value of intensive cultivation has become more generally recognized. At the present time artificial fertilizers are supplied largely from the natural nitrate deposits in Chili, known chiefly as Chili saltpetre; but it has been estimated that this source of supply, with the increasing demands likely to be made upon it, will be exhausted well within the next hundred years. It follows that the production of a suitable substitute is a question which the world's chemists and engineers are now confronted with—a question which finds its solution, in part at least, in the fixation of atmospheric nitrogen by means of electrical energy. The value of this process has been proven, but to date the production of fertilizer by this method has not been rendered sufficiently economical to make it a commercially attractive proposition.

In the Electrical News issues of May 1, May 15 and June 1 several electro-chemical methods for the fixation of atmospheric nitrogen were described, the information being derived from a paper presented recently before the American Institute of Electrical Engineers. The discussions which usually follow the reading of such papers before the Institute have just been made public, and are printed elsewhere in our present issue. The efficiency of the several processes described, from thermal and energy standpoint, is so low that the need of an improvement is at once evident—so evident, indeed, that the whole subject appeals to us as being one of the most likely fields for research looking to the application of modern chemical and electrical science to our industrial development. It offers not only the possibility of a solution of the problem of a suitable substitute for our present fertilizers, but, since the by-products of one chemical process often supply the raw material for another, probabilities of still greater commercial economies are immediately suggested. This discussion opens an entirely new and apparently almost unlimited field for chemical and electrical engineers in Canada. With our great waterways for transportation of both the raw material and the finished products, together with an estimated undeveloped horse-power anywhere from twenty to twenty-five millions at present tied up in our waterfalls and running to waste, and with one of the best markets in the world right at home, there seems to be no reason why Canada should not become the centre of the greatest electro-chemical production of chemical fertilizer in the whole world.

Greatest Aggregation of Power Resources

By the purchase of the Gres Falls power site from the Union Bag and Paper Company, and the recent agreement with the Laurentide Power Company, the Shawinigan Water and Power Company will practically control the most important water developments on the St. Maurice River, P. Q., and will possess, in the words of Mr. J. E. Aldred, the president, the greatest aggregation of power resources under one control in the world. The company have also interests in the Cedars Rapids Company, the Three Rivers Traction Company, and the Dorchester Company of Quebec. The storage dam now being constructed at the mouth of the Manouan River by the St. Maurice Construction Company will considerably increase the water facilities of the Shawinigan Company. The Gres Falls are about four miles below Shawinigan, and are capable of developing between 60,000 to 75,000 horse power, but there is no intention of utilizing the power for the present.

Mr. Aldred looks for a large increase in the demand for power owing to the possibilities of the electric furnace. The Shawinigan Company have decided to establish a new research department, which will investigate the subject of electric furnaces. The directors are putting in the first unit of an acetone plant, and have recently started to manufacture metallic magnesium and are considering the construction of an electric steel furnace.

The directors of the Shawinigan Company have declared a dividend of 1¾ per cent. for the quarter ending December 31st, which is the third increase since 1911. In 1914 the total dividend paid was 6 per cent.

Winnipeg River Possesses Great Possibilities in the Production of Nitrate Fertilizer

During the past few years tremendous strides have been made in the production of electro-chemical products. These industries, requiring as they do large quantities of electrical energy, demand, in order to insure an economic success, that a large and cheap source of power be available. It is in this particular that our water powers are destined to play a very important part, and the industrial development of

Canada will, to a large extent, be dependent upon the degree of development of this great natural resource.

Among the most notable instances of electro-chemical development is the production of artificial fertilizer from the nitrogen of the air. The demand for fertilizer has greatly increased from year to year, and is at present chiefly supplied by natural nitrate from Chili, known as Chili Saltpetre. It has been estimated by authorities that, with the increasing demand for fertilizer, the Chili Saltpetre fields will be exhausted in the next sixty years. Realizing how essential it was to find a substitute for this natural fertilizer, chemists and engineers since the beginning of the present century, have been perfecting an electro-chemical process by which nitrogen can be taken from the air and used in the production of artificial fertilizer.

The consumption of electrical energy in this process is so vast that only in cases where cheap water power is available can this process be economically utilized. The Winnipeg River, for example, with its exceptionally cheap and abundant water powers, furnishes an instance of available power capable of being utilized to great advantage in the production of artificial fertilizer. A most thorough power investigation has been carried out on this river by the Dominion Water Power Branch. This investigation is of great advantage to those interested in the river's water powers, in that it renders unnecessary the otherwise long period for power study prior to development. The available power on the Winnipeg River is capable of producing 300,000 tons of artificial fertilizer per year. This output would be sufficient to fertilize 5,000,000 acres of our land.

As an instance of what has been accomplished by other countries in the production of artificial fertilizer, may be mentioned the Norwegian exhibit at the Panama-Pacific International Exposition. In the Norwegian pavilion there is a chart which shows all the steps in the electrical fixation of atmospheric nitrogen; see reproduction herewith. The chart illustrates how oxygen and nitrogen of the air are combined and converted into nitrates, the source of energy being power generated from water falls. This electric energy is transmitted to a furnace through which is blown a current of air. The furnace consists of a "flaming arc"—an arc like an enormously enlarged street lamp stretched by magnets into a thin circle of flame some six feet in diameter. The tremendous heat generated by this arc causes the nitrogen and oxygen of the air to combine, forming nitric oxide (NO), which can be converted into fertilizer.

The above chart is based on the establishment at Rjukan, where a water power station is located capable of developing 140,000 h.p. This chart, with the following explanation, carries a suggestion as to how the water powers of the Winnipeg River may be utilized in producing fertilizer:—

1. From Rjukan, a water power station of 140,000 h.p., the current is conducted to the furnace-house through sixty cables of a length of three miles each.

2. By blowers, 1,000,000,000,000 gallons of air are at Rjukan driven through the electric furnaces per twenty-four hours.

3. The heat in the furnace, exceeding 3,000 degs. Centigrade, brings about a combustion of the nitrogen of the air resulting in the formation of nitric oxide.

4. These hot gases (800 degs. Centigrade) are being used as fuel in large steam boilers, where the gas temperature is reduced to approximately 250 degs. Centigrade.

5. By water coolers the heat of the gases is reduced to about 50 degs. Centigrade.

6. By remaining some time in large oxidation tanks the nitric oxide gases (NO) are transformed into nitrogen dioxide (NO_2).

7. In passing through three granite towers of a height of twenty-three meters and filled with quartz sprinkled with water, the nitrogen dioxide is absorbed by the water, which thus is transformed into weak nitric acid 30 per cent.

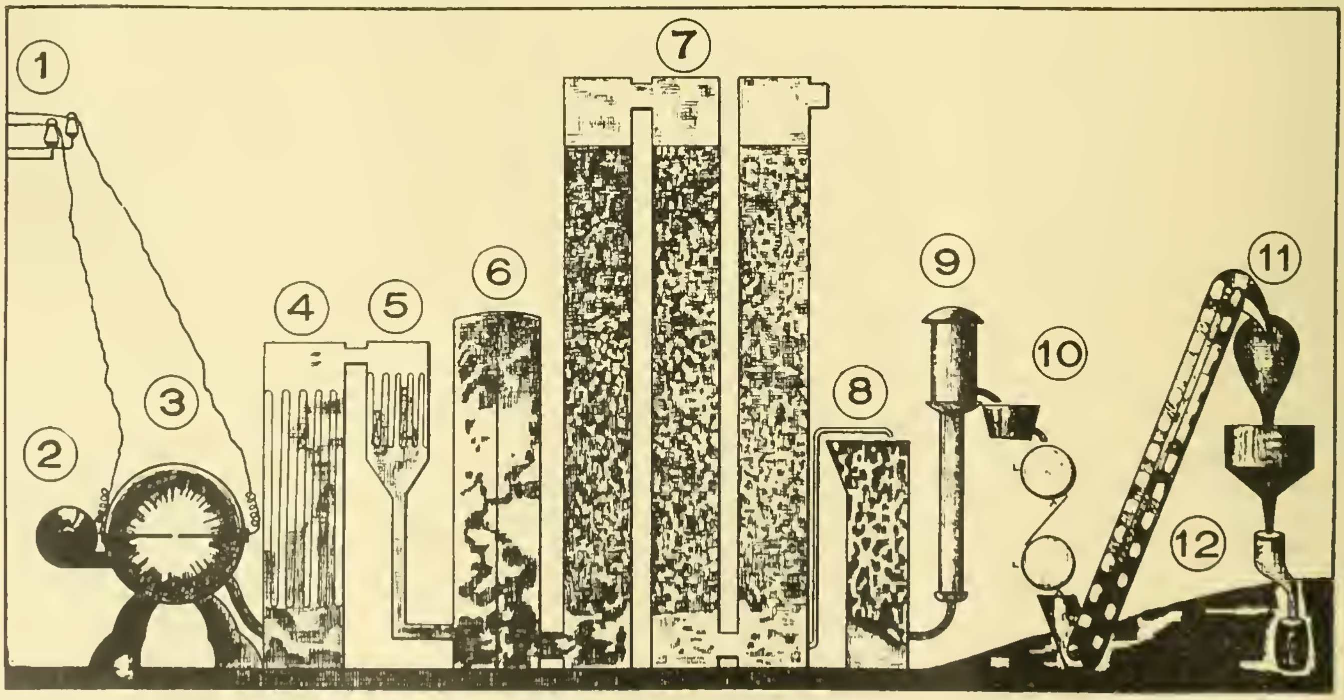
8. The acid is passed over limestone (carbonate of lime); the carbonic acid is removed and a solution of nitrate of lime is formed.

9. The weak solution of nitrate of lime is by evaporation concentrated until it contains 13.1 per cent. nitrogen.

10. The liquid nitrate, being now thick, is passed upon revolving cylinders, which are internally cooled; the nitrate is here rapidly solidified and is taken off in leaves.

11. The leaves of nitrate are granulated in small mills.

12. From high silos the nitrate, in finished state, is filled into barrels of 100 kilograms net weight. At Rjukan the daily production is 2,000 barrels.



1. Leads from water power station. 2. Air blowers. 3 Electric furnace, nitric oxide NO formed. 4 Hot gases used as fuel under steam boilers. 5. Gases pass through water coolers. 6. Oxidation tanks where nitrogen dioxide NO_2 is formed. 7 Three granite towers, nitrogen dioxide absorbed by water forming weak nitric acid. 8. Acid passes over limestone forming nitrate of lime. 9 Weak solution of nitrate of lime concentrated. 10. Revolving cylinders where nitrate is solidified. 11. Solid nitrate is granulated. 12. High silos for filling barrels.

Eugenia Falls Plant Placed in Operation

Hydro Commission of Ontario passes another milestone—Twenty-five hundred horse power available in new plant—Another link in the great chain of networks that will ultimately cover South Western Ontario with light, power and radial facilities

Another hydro-electric generating plant was successfully placed in operation on November 18th by the Hydro Electric Power Commission of Ontario. This was at Eugenia Falls, on the Beaver River, some thirty miles from Owen Sound, the largest town to be supplied by this system at the present time. The Eugenia plant is of particular interest on account of its 540-ft. head—the second highest, we believe, in the Dominion. Two units represent the initial installation, each of 2,250 h.p. on the turbine side and 1,200 kv.a. on the generator side. That the Commission have not misjudged the power requirements of this district is proven by the fact that the load with the first day of operation reached 856 kw., and that at the present time the amount of 1,500 kw. represents the daily maximum requirements.

Line drawings which indicate in a general way the conditions under which this plant has been installed are shown herewith. A somewhat detailed description of the equipment also follows.

With this plant in operation the Hydro Electric Power Commission of Ontario are in a position to cover practically the whole of the area of south-western Ontario, their Niagara plant and Wasdell's Falls, Ragged Rapids, and the Big Shute plants covering the southern and eastern portions. Ultimately all these different distribution systems will doubtless be tied in together, affording a unique network of distribution which will cover probably the largest area in the world under one control, and affording at the same time a high safety factor as regards continuity of service.

The Eugenia Falls system, as shown in Fig. 1, is supplied from a plant located at Eugenia Falls on the Beaver River six and one-half miles north-east of Flesherton. In Fig. 1 the dotted lines represent districts where construction work has not yet been completed. Power is generated at 4,000 volts, and stepped up at Eugenia to 22,000 for distribution to Owen Sound on the north, Shelburne to the south-east, and Durham and Mount Forest to the west and south. Distributing stations are located at Owen Sound, Chatsworth, Dundalk, Shelburne, Durham, Mount Forest. The line to Hanover and Chesley has not yet been constructed, but eventually distributing stations will be placed at these points. Transmission-line construction is according to the Commission's 22,000-volt standard, wooden poles being used throughout.

Markdale, on the Eugenia-Owen Sound line, is supplied direct from the generating station at the generated voltage of 4,000. The arrangement is 4,000-volt, Y-connected, for distribution at 2200 volts. The service wires for Markdale are carried on the same poles as the high-tension wires which supply Owen Sound, the lower voltage wires being placed a little lower down on the poles. Flesherton is supplied in the same way direct from the generating station; the distributing station from which lines go out to Shelburne and Mount Forest is actually placed at Flesherton Junction, and, as already noted, there is no distributing station at this point. The same arrangement is also used to supply Holstein, some five miles south from Durham, where again the 4,000-volt is installed along with the 22,000-volt wires until within a short distance of the village.

The drainage area of the Beaver River above Eugenia Falls is about 74 square miles. The Commission has installed a dam above the falls of about 1,800 acres area with a pondage of about 800,000,000 cubic feet. It is also possible to install another dam at Faversham which will give an additional pondage capacity of 300,000,000 cubic feet. However, this second dam will only be installed in the final development if found necessary for protection.

The maximum discharge at Eugenia Falls, as so far determined by gauge records and discharge measurements, is 99 second feet, which is equivalent to a run-off of 1.34 sec. ft. per square mile of watershed. The minimum flow, 31 sec.-ft., is equivalent to a run-off of .41 sec.-ft. per square mile and the average flow for 1913, 58.9 sec.-ft., corresponds to a mean annual run-off of .8 sec.-ft. per square mile.

The maximum static head at Eugenia Falls is 555 feet and the minimum static head 540 feet. The normal operating (effective head) is 540 feet and the minimum operating (effective head) is 515 feet.

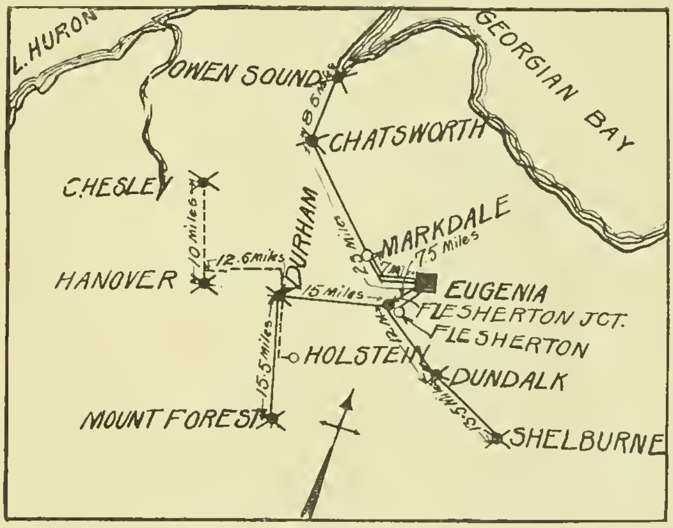


Fig. 1.—Showing present area supplied from Eugenia.

As already noted, the Eugenia Falls plant is supplied from a storage secured through a main dam located above the falls providing storage of approximately 800,000,000 cubic feet. The water is carried from this point by a canal 5,000 feet long, 6 feet wide, to a pond of six acres capacity located in front of gate-house, where it is impounded by a second dam carried six feet above high water mark (earth filled type) 800 feet long; maximum height 30 feet; width at top 10 feet; wall slope, water side, 1 to 3; dry side 1 to 2 slope; rock toes; clay puddle core with puddle cut-off carried 5 feet below surface of ground; double lap timber sheathing carried 5 feet below bottom of cut-off trench to 5 feet above original surface of ground.

The gate house provides entry for two 46 in. wood stave pipes controlled by 66 in. butterfly valves electrically operated and controlled from the power house. Racks are housed and handled by chain block on trolley beam. The gate house is constructed of reinforced concrete with wing walls. The conduit line from gate house to head block is 3,350 feet in length. Head at gate-house is 25 feet; head at standpipe

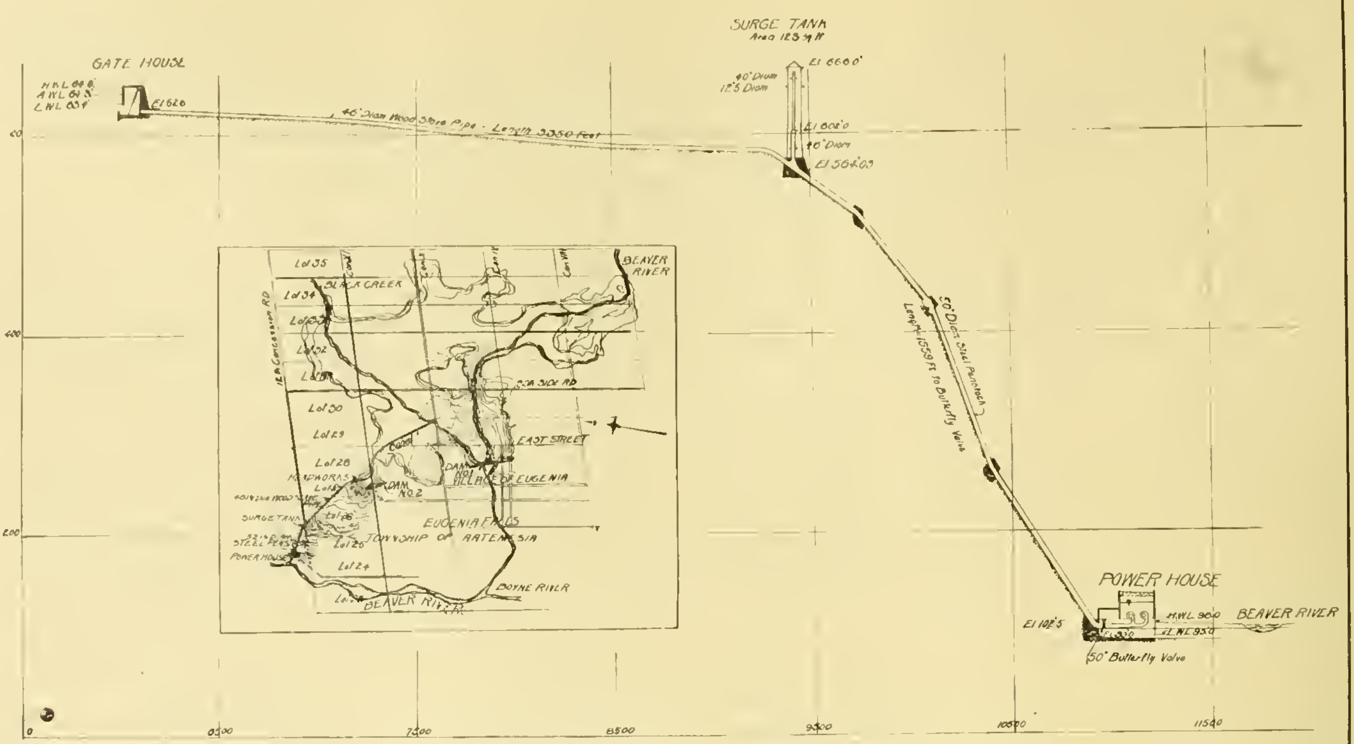


Fig. 2.—Profile and plan of the latest hydro-electric development of Ontario's Commission.

105 feet. Head-block forms junction point for 46-inch wood stave pipes, 52-inch steel penstock and 46-inch steel riser to surge tank and also furnishes foundation for surge tank placed on four steel columns 35 feet in height. Location of stand pipe shown in Fig. 2.

The surge tank consists of a 40-inch riser, 60 feet in length, inside a 12½ feet diameter tank 64 feet high, the base of which is connected to the penstock by a 38-foot pipe 46 inches in diameter.

The 52-inch penstock is constructed of steel, 5/16 inches in thickness at top and 27/32 inches in thickness at bottom. The penstock pipe line is 1,557 feet in length and supported every twenty feet on saddles; also anchored at each vertical bend with four concrete anchor blocks and provided with expansion joints below each point of anchorage. This penstock will be employed ordinarily to feed two machines, but cross connection is secured by means of a 35-inch by-pass, so that machines on number 2 pipe line (later to be installed) may be operated from number 1 pipe. The penstock supply is controlled by a 50-inch butterfly valve located just inside the power house and close to the water wheel. No. 1 penstock feeds two 2250-h.p. turbines of spiral single "Francis" reaction type. Each spiral casing is controlled by a 22-inch gate valve operated from the power house floor.

The turbines are of horizontal type with overhung runners and each is connected on the same shaft with a flywheel weighing 6,000 lbs., a 1,200 kv.a. generator and a direct driven exciter. The speed of the units is 900 r.p.m.

The power house proper is constructed with concrete foundation to floor level and brick and steel superstructure. The tail-race is 400 feet long and 10 feet wide at bottom. The walls of the tail-race have a 1½-1 slope; tail-race empties into Beaver River.

The electrical equipment in the power house consists of three 900 kv.a., 1,000/22,000 volt, 60 cycle, oil-immersed, water-cooled transformers; one 1,200 kv.a., three phase, 60 cycle, 4,000 volt generator 900 r.p.m., three 50 kv.a., 4,000/-575 volt, three phase, 60 cycle oil transformers, as well as necessary switchboards, switching equipment, and lightning protection equipment. The sub-stations are built and equipped according to the regular Hydro Commission standards.

Turbines used in the Eugenia Falls plant are the well-known Escher-Wyss manufacture. The electrical equipment, including generators, transformers, switchboard, etc., were all supplied by the Canadian Westinghouse Company. The contract for the woodstave pipe was awarded to the Pacific Coast Pipe Company, of Vancouver; the surge tank was supplied by the Canadian Allis-Chalmers Company; the steel penstock by the Thor Iron Works, Toronto; the 66-in. butterfly valves at the head gates were constructed by the Boving Company, of Lindsay, and the 50-in. valve at the power house by the Canadian Allis-Chalmers Company.

The Electric Reduction Company, Buckingham, P. Q., are improving their hydro-electric plant on the Lievre River by the construction of a concrete gravity type dam, which will replace a wooden structure. The work is being carried out by the Foundation Company, Limited, Montreal, from plans by Mr. John McRae, Ottawa.

Canadian Trade Gains

For September

	1914	1915
Imports	$36,567,572	$38,026,720
Exports	40,544,094	53,715,882

For the 12 months ending September

	1914	1915
Imports	$531,853,489	$417,272,203
Exports	468,210,010	517,982,240

This is a gain of over $100,000,000 this year, against a loss of over $60,000,000 last year.

Artificial Illumination of Interiors

As related to architecture and decoration—Opens a broad field for the illuminating engineer

By David Crownfield*

Architecture, decorative and artificial illumination are allied arts. Research work carried on in the field of illumination within the last decade has only just begun to show the relation of this latter subject to the two former ones. Further study of this relationship promises much for the future development of the art of illuminating engineering.

The purpose of this paper is to indicate some points of relation between architecturally and decoratively treated interiors and illuminating engineering, in so far as the artificial illumination of these spaces is concerned; also to indicate some of the various features which are inherent in problems of this character, and to discuss the relation of these features to each other, and to some of the more ordinary artificial illumination problems of to-day.

To light a space so it can be used for the purpose for which it was designed, to distribute artificial light evenly throughout any space, or to distribute it extensively or intensely from points of distribution, these are the fundamentals of illuminating engineering. Consideration of these factors so far has been mostly from the point of view of light in its effect upon a so-called working plane, that is to say, upon a surface of two dimensions; and the solution of the problem has been expressed as such. Where the problem has been a complex one, the effort has generally been so to resolve it into an expression that the solution of the problem could be expressed in a curve or in terms representing a surface of two dimensions. A broader view of illuminating engineering compels us to recognize that the proper use and distribution of artificial light and color is neither disjunctively an art or a science, but conjunctively is both.

Beyond the field of really primary problems on which the major part of the illuminating engineer has been concentrated for the past decade, lies the vast and complex region of the effect of light and color upon architecture or objects of three dimensions; upon painted walls and architectural members, or colored surfaces of three dimensions, by which are meant walls having receding planes; upon decorations and pictures, which are painted representations of surfaces of three dimensions; and of the reflex action which all these have upon man's mind, which one may call a fourth dimension that has to be taken into account.

The Function of the Engineer

It has become man's habit to surround himself, according to the state of his development with objects of beauty, architectural, sculptural and decorative; and it is one of the functions of the illuminating engineer to discover the qualities of artificial light, and artificially produced color, and to use them in such manner as will stimulate and develop man's imagination and his interest in whatever there is in the beautiful in his surroundings, either at his work, in his home, or when abroad; for upon his cognizance of these things, particularly those he comes in contact with under artificial light, depends much of his ordinary every-day, natural pleasure in light.

The fundamental principle of all artificial illumination problems lies within the province of esthetics, and the solution of all problems is enveloped by the old adage that "Light illuminates painting and models sculpture." Under painting may be grouped all decorated or plain surfaces of two dimensions. And under sculpture may be listed all other subjects of three dimensions. Granting the above functions of light from the physical standpoint, under one or the other or both of them can be grouped every illumination problem with which the architect, designer, painter, illuminating engineer or layman may have to do; for a ray of light expresses equally the beauty or quality of form whether falling upon a sculptor's masterpiece, an order of architecture, or a modern stair-rail spindle revolving on the turner's lathe, it expresses equally the quality of decorative form and color whether falling on a Gobelin tapestry, a modern Turkish rug, or on an inexpensive wall paper in an humble artisan's home of to-day.

Light falling on surfaces of two dimensions illuminates them, falling on objects having three dimensions it models them. Light falling on an architectural member will cause it to cast a shadow on what is below and behind it, or, if the light is below any horizontal plane, above and behind it. If the receiving surface is a flat one, the shadow will express the form of the object casting the shadow; if the receiving surface is rounding in form or is one of receding or projecting planes the shadow will express in part the form of the receiving surface; if both objects are curving in their surfaces or angular and curving, or contain curves of double flexure, the shadows cast will be extremely subtle in their nature. It is the province of the illuminating engineer to so locate the light outlets, assign the quantity of light at each outlet, and arrange the distribution of light from each of these, that the architectural members or decorations in any interior will be adequately expressed by the artificial light falling on them that their shadows shall not be obliterated, or ugly, or false, or distorted, or hard and inartistic.

Poor Lighting Spoils Work of Artist

When light falls on a painting or decoration, it falls on a surface of two dimensions. An artist by his talent is able to create the third dimension of depth in his picture; if he is a genius he may create what may be called a fourth, which lies within the domain of psychology. This feature may be destroyed by poor and particularly by overlighting. The light in a room containing pictures should be so located that it will adequately illuminate the picture or pictures contained therein; it should be so located that it will do this without coming into the range of vision, and that it will not overcast the shadow of the surrounding frame or shadow box, if the picture has one; it should also not be placed in too close proximity to the surface of the picture, for if that be painted in broad, heavy strokes the artificial light will cast shadows of these, or it will catch on the raised portions of the brush strokes and over illuminate them, and make false high lights in the picture, and so create an actual third dimension and introduce features the artist did not intend or destroy the balance of the picture.

The light falling on a picture or decoration should be so controlled as to location, quantity and brightness that no objects in the surrounding field is more brilliantly illuminated than the highest light in the painted picture, for surface brightness of surrounding objects should never be allowed to contest with a picture for the interest of the retinal activities of the eye. This does not mean that a room or space shall not be brilliantly illuminated in parts, but is a rule whose rigidity permits of no infraction so far as the visual

* A paper presented at the recent annual convention of Illuminating Engineering Society.

field immediately embracing the picture or decoration is concerned.

In a room or space containing modelled plaster enrichment, or architectural members, in proximity to painted decoration, if we increase or decrease the quantity of light falling on them, it will affect the architectural members or plaster enrichment more than it will the painted decoration, for the surface brightness of both will be equally increased or decreased, and, while the light and shadows in the plaster enrichment will be increased or decreased in contrasting relation to each other, owing to the law of contrast, this will be greater in the architectural members than in the decoration which has but painted lights and shadows. This statement is based upon the assumption that the outlets are properly placed to cast the shadows of the architectural members agreeably and in a manner to express their form, and that the color quality of the light is such as to preserve a true balance as far as the color values in the painting or decoration are concerned. If one changes the color quality of artificial light it will affect the painted decoration more than it will the enriched and modelled plaster work, for every picture or decoration is supposedly a balanced color scheme with one dominant color or tone. Changing the color quality of artificial light falling on a picture or decoration to one other than that under which it was executed, upsets the balance of the color scheme and thus destroys the harmony of color intended by the artist. No such result occurs as far as the enriched plaster work or architectural members are concerned, if these be not colored; if, however, these be colored, they will be affected more than the picture or decorations are, for the color on plain spaces and architectural members is usually flater than that on paintings and decorations, reflects less light and consequently absorbs more of the impinging colored light and so is affected more.

Aside from theatres, auditoriums and ball rooms, the color scheme of most rooms is determined by daylight, by which I mean its color quality when the sun is not less than 30 deg. above the horizon at sunrise or sunset and the sky normally clear and not overcast. Frequently such rooms become more agreeable when a slight glow of early evening sunset comes in; while exactly the reverse occurs if the day becomes more grey than normal. If one places side by side in a row, and in the order named, a carbon filament, a tungsten filament, a gas-filled tungsten lamp, and a mercury-arc lamp, there is obtained about the exact order in which these sources pleasantly affect a color scheme into which they have been introduced, the carbon filament lamp being at the top. If any architect or decorator is shown an interior comparatively lighted by these different light sources, and asked to state his preference he will instantly pick out the one illuminated by the carbon lamp. The reason for this lies in the fact that the yellow light of the carbon lamp added to any of the other colors and variations of these, while it may destroy their real color value, leaves them within the range of agreeable color sensations, while the light from any of the other artificial light sources named, modifies all the colors in a manner that may leave them distinctly less agreeable sensations than they are under daylight or under the light from a carbon filament lamp. Satisfactory artistic results in the handling of such sources depends on their being enclosed in color modifying light transmitting media that will bring their light into the range of agreeable color sensations. Such media should, however, have such transmitting qualities as will preserve the efficiency of the light source.

Location of Light Source Important

The effect of the location of the artificial light source or sources upon architectural members in any interior space is of very great importance. Conceive, for example, a room whose side walls contain pilasters at regular intervals, or if it is of simpler character, recessed spaces; and further conceive the walls and architectural members to be done in one color of the same tone throughout. It is not at all difficult to conceive of artificial light outlets being so located in such an interior as to cast no shadows whatever from the architectural members. Or one may easily conceive of their being so located that the shadows of some of these members will be false, and of some forced, by which is meant that the light will be too close to them and the shadows hard. In either of these cases the artistic reason for the introduction of the pilasters will be defeated. And in the last two cases the result will be extremely inartistic and unsatisfactory.

Again conceive a ceiling which is divided by beams into coffers, there being three coffers next to each wall and one in the centre, or nine coffers in all. Such a ceiling might be over the dining room or living room of a private house, or over the reading room of a public library, or over almost any space in a private or semi-private, or in a public or semi-public building. It may be square, or one axis may be longer than the other. If it be square and the beams cross each other in a proper architectural division, it will be a simple matter to place the outlets at the points of intersection of the beams. If, however, one axis is larger than the other, the situation is more complex. Suppose an outlet has been placed in the centre panel and one at each intersection of the beams, as this is a treatment which is generally given —the result will be that unnatural shadows will be cast from the centre light source towards the wall by the beams which follow the long axis of the room. The distorted and false shadows thus cast will be very objectionable and can only be obviated by the side wall brackets so placed as to cut out the objectionable shadows. It is obvious from this that the location of the light sources in any layout bears a direct relation not only to the distribution of the light but also to the proper expression of the architectural features of the room in which they are placed.

Effect on Decorations

The effect of the location of the light source upon painting and decoration or colored surfaces in the surrounding field may be illustrated by returning to the previous simile of a room whose side walls contain pilasters at regular intervals, or of simpler character with recessed spaces. In the former case conceive the ceiling and pilasters to be done in tones of cream color and the panelled spaces between the pilasters to be done in a sage green or some other color distinctly darker than the pilasters. If a single outlet be placed in the centre of such a room, regardless of whether it be square or rectangular in plan, it necessarily follows that the centres of each wall space directly opposite the light will be lighter than the portions towards the corners, and as the angle of the impinging light becomes more acute as the corner is approached, the color will become deepened. This is due not alone to the added distance, but it is also due to the irregularities in the surface which reflect the impinging light away from the beholder's eye, leaving the actual colors on the walls towards the corners less modified by the light falling on it than occurs towards the centre of the wall spaces. While such a result is not undesirable it is to be avoided as much as possible in all the treatment of rooms of a public or semi-public character, when a general distribution of light is desirable and should be attained.

There is another aspect of artificial illumination requiring consideration, namely, the use of artificial light in a so-called decorative manner. From what has been said of the capacity of light to illuminate decoration and painting, and model architectural members, and of the manner of handling artificial light so that it may best fulfil these functions, it is

obvious that this does not permit of a large number of small individual units to mark the outlines of various architectural members in any interior space. Such a use of light units brings them so close to objects in the surrounding architectural field, with resulting distorted and awkward shadows, that the objects are not truly and artistically represented. Artificial light units placed in the manner above referred to should only be used exteriorly for advertising purposes to display the outlines and points of a building.

There is a physiological aspect of the present theory of vision that should be taken into account in considering the relation of artificial light to architecture and decoration. Accepting the theory that it is the function of the rods and cones in the seeing forces of our eyes, to make selective presentation to the brain centres, of light and form and color, and that the rods respond to light, by which is meant white light, and grey when that is the result of a mixture of white and black, or of a balanced true grey when it is composed of other color. The rods respond to form when that is not enveloped in color. The cones convey to the brain centres all sensations concerned with color. It is at once evident that the different functions thus performed bear a very direct relation to the artificial illumination of interior space.

Light Phenomena in Certain Interiors

In an interior, such as a church of the colonial type of architecture, be decorated in tones of grey with the color inclining visibly but not strongly towards say a bluish grey, so that one regards the church as being decorated in grey but is at the same time aware of its bluish cast, it often appears that spaces, when they are so artificially lighted, give a result which is extremely unsatisfactory. The color sensation seems to oscillate between grey and blue. Those portions of decorated surface adjacent to artificial light sources seem to be a true grey, while portions more remote, and particularly those in corners become bluish violet in color. A person sitting in such an auditorium for any length of time becomes extremely restless, and very much more so under artificial light than when the place is lighted by daylight. This phenomenon is due to the fact that the plus of yellow in an artificial light source carries the grey color of the decoration nearest adjacent to it more towards a true grey in which no particular color is a dominant, throwing this portion of the wall into the range of sensations to which the rods respond, while the corners and more remote parts which partake of a distinct color value of bluish violet are carried into the range of sensations to which the cones respond. Between these two extremes is a running range many parts of which are extremely difficult to assign as either grey or color. I can find no solution of this difficulty other than that it is the effort of the rods and cones or seeing forces of the eye to pick out from this intangible field and convey to the brain that which it is their especial function to perform that causes the restlessness of a person sitting under such a color scheme. Trouble with grey color schemes usually occurs where there is an over plus of bluish violet or reddish violet in the color scheme. The satisfactory solution of the trouble often devolves upon those having charge of the lighting scheme as it does not appear until that is a working installation.

The Law of Conservation

The selective functions of the rods and cones of the eye, in bringing to our consciousness form and color, is an exposition of the law of the conservation of energy that is too seldom regarded in the artificial illumination of any piece of work, for the true apprehension of any object by means of the organs of sight may be regarded as a piece of work to be done, and it is apparent that if one divides the work or operation of seeing any object between two apprehending functions one has divided the work to be done between them, with consequent lessening of the working strain on each. The results of research work along this line suggest great possibilities, more particularly in so far as the performance of work in mills and factories is concerned. May it not be that if a workman is turning a grey bar of steel in a lathe whose color is grey, as such machines often are, or an operative working in, let us say, a cotton mill, with a white thread against the grey background of a machine, that only the rods of the operative's eyes are active. If, however, the machine were colored, as it well might be, both the rods and cones would be active, with the work being done, divided between them and a consequent lessening of the strain on each of these forces individually.

Municipal Plant in Vegreville

Vegreville, located 75 miles east of Edmonton on the Canadian Northern Railway, is the only town or city in Northern Alberta which can boast of real competition in the matter of electric lighting. In 1908 the council granted Thos. Weeks an exclusive franchise for fifteen years for electric light and power; the plant was put in operation in the fall of that year, and it has been in operation since then. According to the council of Vegreville the facilities furnished by Mr. Weeks were inadequate to the needs of the town, and frequently, representations have been unsuccessfully made to him to improve his service.

Mr. Weeks originally installed a 75 h.p. producer gas engine and a Canadian General Electric 220-440 volt d.c. generator. In 1913, after the necessary by-law had been passed, the town started to build a new power house without making an offer to the owner of the old power plant. However, they could not sell the bonds for the new plant, and progress was very slow. The power house was built about one mile and a half from the station. A good deal of trouble was encountered with quicksand, part of the building caving in and having to be rebuilt. Finally, on August 15th, the plant was put in operation with about forty houses and public buildings connected. Rapid progress is being made in getting new connections, as a large number of customers on the old system are changing over to the new system anticipating better service. The town of Vegreville is giving light at 14 cents per kw.h., while Mr. Weeks sells power at 12 cents a kw.h.

The town of Vegreville has notified Mr. Weeks to remove part of his lines from certain streets, or they will do so themselves. An injunction was secured against the town, but at a recent hearing the Judge held that under Mr. Weeks' contract he has no right to use the streets of Vegreville for his lines, but that the town must compensate him for the cost of removing his lines from the streets. So far no agreement has been arrived at. It must be noted that a town or city cannot grant an exclusive franchise for more than ten years, unless approved by the legislature, and, Mr. Weeks having failed to secure authority, the court claims that he has no right in the town of Vegreville.

The town installation consists of two 100 h.p. high speed vertical engines manufactured by the Goldie McCulloch Company, Limited, running at 514 r.p.m., direct connected to two Canadian Westinghouse generators of 62.5 kv.a., 3 phase, 2200 volts. An up-to-date switchboard of blue Vermont marble contains the following apparatus: an indicating instrument for each generator, mounted directly opposite the engine in the operating room; one volt meter; three ammeters for the a.c. side, and one voltmeter connected to the exciter; the exciters are belt driven from the engine shaft. The boilers are of the return tubular type, manufactured by the Goldie McCulloch Company, having a capacity of 100 h.p. and operating at 125 lbs. pressure. A 750 gal. per min. Fire Underwriters' pump has also been installed in the power house for the purpose of furnishing water to the town.

Fixation of Atmospheric Nitrogen

Discussion on recent paper by Mr. Summers, before A. I. E. E.

Joseph W. Richards: In considering the arc process, we can say that it is essentially an electrochemical process. Last summer I had the pleasure of visiting the largest of these plants in operation at Rjukanfos, in Norway. In a valley that five years ago contained five houses, there is now a town of ten thousand inhabitants, with a power plant of 250,000 h.p., and they are shipping their products practically all over the world.

The cyanamide process had also its origin in an electrochemical establishment. Mr. Wilson, down in the South, tried to make aluminum in an electric furnace. He put some lime in the furnace, accidentally making calcium carbide. That was the root of the cyanamide process, so that it is essentially electrochemical in its origin.

The Serpek process originated in the discovery that metallic aluminum could absorb nitrogen from the air, and that the product when acted upon by water gave off ammonia, giving rise in the mind of Mr. Serpek to a commercial method for manufacturing aluminum nitride, and decomposing it to get ammonia.

The thing that makes these processes most interesting, is their wonderful inefficiency from the thermal and energy standpoint. Regarding the 250,000 h.p. used in Rjukanfos, Norway, there is actually utilized for the chemical operation 3,500 h.p. All the rest of the 250,000 h.p. is lost, the efficiency of that operation being about 1.4 per cent. on the power used. We were used to such inefficient operations in the past, in such cases, for example, as melting crucible steel, which had a fuel efficiency of 2 per cent.; but in so many cases have we progressed that the wonderful room for improvement here is one of the most striking, one of the most interesting and most attractive things about the whole subject to the electrochemical engineer.

The cyanamide process, however, does considerably better as far as power consumption is concerned, and it rises to over 6 per cent., as I calculate the thermal efficiency. Mr. Washburn's remarks as to the very favorable comparison of the cyanamide process to the arc process, probably has its deepest root in the higher thermal efficiency. The Serpek process, if it could be worked, would be approximately of the same thermal efficiency as the cyanamide process, but up to the present time it has not been commercially operative, although perhaps a half million dollars has been spent upon experimental work. One cannot help feeling, however, that something may result from that expenditure and that by some modifications of their fundamental ideas, as to how to conduct the process, the process may become commercially successful.

The Serpek process produced alumina as a by-product. If it produced all the alumina required in the aluminum industry, there would be only 40,000 tons of nitrogen produced yearly as a maximum.

Theoretically the union of nitrogen with oxygen at 100 per cent. efficiency should give about 1 kilogram of nitrogen per h.p.-hr., or approximately 1,320 g. of nitrogen per kw.-hr. The cyanamide process gives about 70, and the arc process about 16, so that the great room for improvement is at once evident.

The possibility of converting the ammonia produced from cyanamide into nitric acid by a highly efficient process is undoubtedly an important question. I have seen one such process in operation at between 90 and 95 per cent. efficiency on the ammonia produced. All these small details of the operation of the process fade, I think, when considering the thermal inefficiency and the great room for improvement which is still possible. It is such a rapidly advancing art that I do not wonder that the putting of money into buildings gives one great concern, because there is no knowing at any time but what some electrical engineer, or electrochemical engineer will come along with a process about twice as efficient. This efficiency would threaten to scrap all the processes now in operation. The whole subject appeals to us all as being one of the best applications of modern chemical and electrical science to industry; one which has an immense, almost inconceivable, future.

J. L. R. Hayden (by letter): In the discussion of the limitation of the arc furnace process the possible concentrations are calculated on the basis of the thermodynamic equilibrium, though the work of Haber makes it very doubtful whether the arc furnace process is a thermodynamic one.

An extensive series of investigations, which I made some years ago in Dr. Steinmetz's laboratory, led me to the conclusion that in the fixation of nitrogen by the electric arc the conditions of thermodynamic equilibrium are of secondary, if of any moment; and the process is essentially an electric one. A series of experiments with arcs of different temperature seemed to show no direct relation of the NO concentration to the arc temperature as depending on the arc stream material. In order of their NO producing efficiency, the arc electrode materials arranged themselves in the following order:

Iron: Highest NO concentration.
Titanium,
Carbon,
Copper: Lowest concentration.

While the order of the boiling points of these materials is:

Carbon:	Above	3600 deg. cent.
Titanium:	About	2700 deg. cent.
Iron:		2450 deg. cent.
Copper:		2310 deg. cent.

Carbon, of the highest arc temperature, is very low in efficiency, while iron and copper, with approximately the same arc temperature, are at the opposite ends of the scale.

With low-temperature arcs, as the mercury arc, it is easily possible to get concentrations above those representing the thermodynamic equilibrium.

From this and other results of the investigation, I am led to the conclusion that the NO production by the electric arc is essentially a dissociation phenomenon. In the arc stream, the molecules of oxygen and nitrogen are dissociated into free atoms, and when leaving the arc stream, these atoms combine with each other by the probability law. As air contains four times as much nitrogen as oxygen, each oxygen atom has four times as much chance to find a nitrogen atom as an oxygen atom, and thus four NO would be formed for every O_2 and in the same manner 4 N_2 for every NO. The gases leaving the arc stream should, therefore, be a mixture containing 32 per cent. NO. As at high temperature the reaction velocity is extremely high, the NO concentration rapidly falls to the low concentration of the thermodynamic equilibrium. The more rapidly the gases are cooled down to the temperature where the reaction velocity is low, that is, the mixture stable, the higher a percentage of NO would be preserved. Also, the lower the initial temperature, that is, the arc temperature, the higher, with the same rate of cooling, should be the NO produc-

tion. The low temperature arc therefore should be the most efficient. In agreement with this is the above table, where, with the exception of copper, the materials arrange themselves in their efficiency of NO production about inverse to their boiling points. The abnormally low efficiency of copper may be explained by the tendency to instability of the copper arc.

David B. Rushmore: In all the talk of conservation that has been going on for the last few years, we have had a great deal that was thoroughly high-class and desirable, and a great deal that was not. Practically nothing has been said about the fact that our civilization is absolutely founded on from four to six inches of soil on the surface of this earth, and the conservation of that thin layer is an absolute necessity. We in this country have not yet learned very much about how to do it.

Now, the object we are after, or one of the objects in manufacturing nitrogen products, is not necessarily to make the cheapest fertilizer. What we are after is the cheapest finished product, and in many cases the finished product of one industry is the raw material of another. The finished product of the fertilizer industry is the raw material of the agricultural industry, and that is very little understood. As Mr. Washburn has just said about the manganese sulphate, you used to hear a man just becoming interested in agriculture talk about fertilizing as if it was the simplest thing in the world—you simply analyze an apple on the tree, find what is the percentage of the different elements in it, spread these elements at the root of the tree, and that is all. As a matter of fact, there is a vast deal to learn—how the elements of the fertilizers react upon each other, and react upon the elements that are already in the soil; how they become available for plant life. We must also bear in mind the fact that the operation of fertilizers in a grove of trees must necessarily be intermittent, that it is affected by a certain amount of rainfall and sunshine, which evaporates and washes away the constituents of the fertilizer, and also that the action of bacteria is just beginning to be understood. This leads us to suppose that our present mode of applying fertilizers to plant life is probably extremely crude and inefficient, and that we know but a very small percentage of what ought to be known of the best form in which these fertilizers should be applied.

A point of view not generally understood and appreciated is the close relation between the production, transmission, transportation and distribution of energy and of commodities. Mr. Washburn brought out a point in regard to the necessity of nearby water transportation which is extremely interesting and is very important; and also the point that a great deal of the interest in nitrogen processes is because of the healthy and well-founded search on the part of our power companies for a load for their excess capacity and for an intermittent demand.

If Mr. Washburn's statement in regard to transportation is accepted in a very definite sense, it would mean that water power if removed from water transportation could not look forward to this load, but waterpowers removed from water transportation are often surrounded by very large agricultural regions. These must be fertilized in some way, and might as well draw on a centre of local supply—take it somewhere between the Mississippi and the Pacific Coast—as to ship in fertilizer from one end. I am sure Mr. Washburn, who is most unusually situated as a nitrogen manufacturer and a water-power operator, simply did not go into the detail of his meaning.

To me one of the most interesting things brought out in the first paper is the reason for the limitation of the process along certain lines. I happened to know people who were experimenting—I am not sure how intelligently—on improvements of the arc process without a knowledge of the fundamental factors that enter into the situation, and without knowing just the part played by the electric field, which has not been mentioned to-night, in the temperature pressure and velocity of change. It seems to me without this knowledge a very great deal of blind and expensive experimenting would necessarily follow. It is not clear to my mind why the electric field, which can work on the oxygen molecule to dissociate the atoms in the form of ozone, and if compressed a little further, as we know, results in nitrous oxid—why that electric field could not be a possible factor in a process of this kind.

Charles A. Doremus: Provost Edgar F. Smith of the University of Pennsylvania has written a book on "Chemistry in America." In that volume he gives three reprints; one a paper by Robert Hare, a member of the Philadelphia Chemical Society, written in 1801. Hare gives a picture of the oxy-hydrogen apparatus and his blowpipe, and it has taken us seventy-five years to come to the practical use of the process of oxy-hydrogen welding and cutting, and the oxy-acetylene process. The second is an annual address by Henry P. Smith, of that same society, delivered in 1798, worthy of reading, as showing the wide knowledge that these men possessed of the possibilities of chemistry in this country and the influence of the science upon the growth of the nation. The last is an address delivered in 1801 by Dr. Felix Pascalis, in which he refers to the manufacture of nitric acid from the nitrogen of the air, by the improved apparatus of citizen Guyton de Morveau.

It has required a world conflagration to make us appreciate our possibilities, and there is no more fertile ground to work on in this country than that which Mr. Washburn has pointed out.

F. V. Henshaw: I ask Mr. Washburn if he will be kind enough to elaborate a little further on the necessities of location. Is the necessity for a cyanamide plant being on tide water, or where there is water transportation, based on the requirements for raw materials, or has it any connection with the shipment of finished products?

Frank B. Washburn: In my reference to the limitations of the interior point of manufacture, I had in mind the manufacturing of ammonia phosphate, which requires not only the raw materials used in cyanamiding, but also phosphate rock. Phosphate rock is found in this country practically in only two places, in the state of Florida and the state of Tennessee. It is a low grade material, and its transportation by water from Florida is very cheap. Its transportation by rail to the interior is very expensive. If it were purely a question of a cyanamide factory, there are interior points that would serve the agricultural requirements of the neighborhood and environment, just as Mr. Rushmore surmises. Beyond all that, my remarks were affected by the broad plan which those who have given the subject consideration think must be adopted to make the best success of a modern nitrogen undertaking. It has got to be a case of concentration, of a large organization made up of the very best skilled and selected men that can be found. In anything which has to do with the electric industry, there is a tremendous advantage in manufacturing at one point, because almost every process gives rise to what may prove to be the raw material for an additional process. Therein lies the success for the Germans, and therein lies the handicap of the United States in going into the chemical industry and taking, as many of us have discussed and debated doing, the trade during the time that the German industries are idle.

Therefore, from that point of view we have not considered, and of course could not consider, locating in a great many places. The cost of transportation of raw materials—phosphate rock, for instance—from almost any part of the Atlantic, in fact from down on the west coast of Florida into Canada, by water, is cheaper than the transportation of that

same material out of Florida a few miles north of the Florida border by rail. The transportation of coal which is converted into coke has many of the same aspects. The transportation of the finished product has to be done at the cost of handling it and loading it into the ship and out of it, as the boats would otherwise return empty from any large water-power plant having deep sea entrance. Practically the same conditions apply to our investigations on the west coast.

So, as a general statement, the practical thing to do in a great manufacturing industry, employing water-power running into the hundreds of thousands of horse power, is to locate within a seventy-five cent barge rate of New Orleans on the Mississippi River system, or upon deep water, or where deep water can be reached rapidly on the Pacific or Atlantic coast.

F. V. Henshaw: What would be the relative tonnage in the phosphate ammonia process,—the tonnage of the raw material and finished product, 5 to 1, 10 to 1?

Frank B. Washburn: I think in the case of ammonia and phosphate it would be 4 to 1, probably.

Leland L. Summers: I want to answer Mr. Rushmore's question, as it seems to apply particularly to the point I raised: Why is not the electrical effect of the arcing system, with its ionizing element, of tremendous importance? The electron effects under partial pressure are very pronounced. The question arises why should we not use such a process as the arcing system, where there is a tremendous magnetic field distorting the arc, so that the flame expands into a wheel six or eight feet in diameter and sounds like a battery of artillery when you open the furnace. It is amazing that there should not be a more pronounced electronic or ionizing effect. The truth is at these temperatures dissociation is so active, though you had an electrical effect you cannot remove the product with sufficient rapidity. The final effect in all the arcing processes is due to thermal energy only.

You asked more in regard to ozonizing and low temperature work. Ozone is produced almost entirely at low temperature. If you use an incandescent wire and liquid air, you can produce ozone, so that you might refrigerate oxygen some time in an active form. You might activate nitrogen by temperature, and hold the oxygen in a more active form, produce chill, and in that way produce a greater effect and be free from this temperature of dissociation. It is entirely theoretical. It has been experimentally done and some interesting results obtained, but I do not know of any actual application commercially.

Electric Load and Output in Large Cities

In the course of a recent investigation made by Mr. H. E. M. Kensit, of the Dominion Water Power Branch, in connection with power questions in Western Canada, a very interesting table has been prepared showing the per capita consumption of power in Greater Winnipeg as compared with other large cities in Canada and the United States.

The necessary data was collected from official sources, special care being taken that all sources of supply within a given city and district, including that for street railways, were incorporated. It should be added that this is not a selected list. Enquiries were made from a considerably larger list and all cities have been included for which the returns received were sufficiently complete and definite.

The most striking point in the table is probably the high per capita position taken by Greater Winnipeg as a user of electric power.

This is probably accounted for by:—

1. The extremely low cost of electric light and power in Winnipeg and district.

2. The high cost of coal and gas in that district.

Where the price of electric light and power is as high as it is in most American cities and coal is cheap, or comparatively cheap, it means that there will be extensive use of gas and other illuminants and that many private fuel plants will be maintained for the production of power, so that the central station load is smaller than it would otherwise be.

Mr. Kensit's table is presented herewith. The data compiled forms a valuable addition to the available sources of information on power consumption.

Electrical Central Station Load and Output in Various Cities. Year 1914.

		Population		Connected load in K.W.		Peak load K.W.		Output in K.W.H. generated		Figures include:—
	United States	Census 1910	Est'd. 1914	Total	Per Cap.	Total	Per Cap	Total	Per Cap.	
1	Atlanta, Ga.	154,839	199,740	88,000	0.440	44,320	0.222	145,684,803	730	Georgia Railway & Power Co.
2	Buffalo, N. Y.	423,715	457 900	137,872	0.310	67,424	0.147	302,220,107	660	Buffalo Gen. Elec. Co. & Cataract Power & Conduit Co.
3	Chicago, Ill.	2,185,283	2,436,000	852,000	0.350	344,500	0.142	1,280 962,600	527	C'wealth Edison Co., Str. Railway Co.'s & Sanitary District.
4	Columbus, Ohio	181,548	213,900	49,309	0.230	19,471	0.091	70,283,250	329	Columbus Railway, P. & L. Co. & Municipal Dept.
5	Detroit, Mich.	465,766	583,000			87,800	0.150	329,395,900	565	Edison Ill'g. Co. & Municipal Dept.
6	Louisville, Ky.	223 928	232,350	97,000	0.417	28,200	0.122	100,692,219	433	Louisville Gas & Elec. Co. & Str. Railways.
7	Milwaukee, Wis.	373,857	420,000			46,924	0.112	170,889,000	406	Wisconsin Edison Co. & C'wealth Power Company.
8	Minneapolis & St. Paul	516,152	601,900	144,778	0.240	91,655	0.152	270,168,475	450	Minneapolis Gen. Elec. Co., Consumers Power Co. & Twin City Rapid Transit Company.
9	Nashville & Chattanooga	154,968	179,590	60,843	0.338	20,200	0.113	71,401 500	398	Nashville Railway & Light Co.
10	Philadelphia	1,549,008	1,671,000	202 086	0.121	82,078	0.490	275,711,745	165	Phil. Electric Co. & Str. Railways.
11	Pittsburg	553,905	572,700			71,000	0.124	316,500,000	553	Duquesne Light Co. & Penn. Light & Power Co.
12	Portland, Ore.	207,214	314,000			47,775	0.152	199,166,000	634	Portland Rly. L. & P. Co. & N. W. Electric Co.
13	Providence, R. I.	224,326	249,000	82,060	0.330	39,700	0.160	113,286,600	455	Narragansett Elec. Lt. Co. & Rhode Island Company.
14	Rochester, N. Y.	218,149	248,000	68,177	0.274	29,813	0.120	123,850,785	500	Rochester Rly. & Light Co.
15	St. Louis, Mo.	687,029	740,400			92,176	0.125	319,151,753	430	Union Elec. Lt. & Power Co., The Elec. Co. of Missouri, United Rlys. Co. & Laclede Gas Lt. Co.
16	Toledo, Ohio	168,497	187,250	60,315	0.322	23,965	0.128	91,996,426	491	Toledo Railways & Light Co.
	Canada	Census 1911								
17	Montreal, Que.	470,480	570 500	222,000	0.384	65,000	0.113	300 000,000	520	Montreal Light, Heat & Power Co.
18	Toronto, Ont.	376,538	468,000	178,677	0.382	64,064	0.137	250,240,500	535	Elec. Lt. Co., St. Rly. Co. & Hydro-Electric System.
19	Vancouver, B. C.	100,401	186,400	61,290	0.330	34,300	0.184	124,884,565	668	B. C. Electric Traction Co.
20	Winnipeg, Man.*	136,035	226,000	136,000	0.600	43 300	0.191	167,765,000	740	Winnipeg Elec. Rly. Co. & City Lt. & Power Dept.

NOTE: The above particulars were obtained by correspondence with the respective undertakings. Special care was taken to cover all sources of public electric supply for each city including street and elevated railways; the figures are, therefore, believed to be substantially correct, but as the local conditions are not known in each case the figures are only given as approximate. The electric load and output covers the city and district in every case. The figures per capita cannot be exact as the population in 1914 had to be estimated, estimation being determined on basis of average annual increase shown by census returns for 1900 and 1910.

*For the above purpose the population of Winnipeg in 1914 is estimated on the same basis as the other cities. The 1914 population was estimated for assessment purposes at 203,255, so that the figure taken (226,000) is unfavorable to the city for the above purpose. The population of Greater Winnipeg in 1914 is estimated by Henderson Directories Ltd. at 270,177, but for the other cities only the population within the city limits is included and Winnipeg is therefore taken on the same basis.

Power Production at the Brazeau Collieries—Brief Description of Operations

By A. J. Cantin

The Brazeau Collieries, Limited, of Nordegg, Alta., enjoy the reputation of being able to deliver more coal in twenty-four hours than any other mine in Northern Alberta. Their mine is situated 130 miles west of Red Deer, on the Canadian Northern Railway, at the foot of the Rocky Mountains. It was first started in the summer of 1913, and has been operated every day since, giving employment to about four hundred men. The coal is bituminous, and of very good steam quality; it is not suitable for domestic purposes. One of the features of the mine is its electrical operation, it being operated altogether by electricity generated in the company's own plant close to the entrance of the drift shaft and distributed at 2300 volts alternating current.

The writer had an opportunity of making a thorough inquiry into the cost of producing the power, and ascertained that for the last twelve months the cost of manufacturing 1,000,000 kilowatt hours, had been 2.5 cents per kilowatt hour. This cost seems a rather high one, considering the low cost of the coal, which they obtain at the actual cost of mining, using mostly mine-run coal.

Perhaps an outline of the organization of the power house and its running costs will be of interest to a number of readers. The labor cost is approximately $50 a day. There are three engineers, working in shifts of eight hours each; three firemen; one electrician, who, together with an assistant, supervises all the electrical apparatus, and also looks after all trouble in the one hundred and twenty cottages and business houses connected with the mine. A master mechanic looks after the steam, as well as the mechanical end of everything in the operation of the mine. The electrician, engineers, and firemen report to him. The consumption of coal averages twenty tons a day. Oil, repairs, and other incidentals bring the total expenditure up to seventy-five dollars a day, in addition to the fixed charges which the plant has to bear.

The generating equipment for this plant consists of two horizontal Leonard & Son single expansion engines operating at 200 r.p.m., direct connected to a Canadian General Electric alternator of 185 kw. capacity, operating at 2300 volts, 3 phase, 60 cycles. The exciters are belt-driven from the main shaft of the generator.

The switchboard consists of eight slate panels having mounted on them the following apparatus: three integrating Westinghouse switchboard type watthour meters, two Weston d.c. voltmeters and ammeter, being controlled by plugs so that they can be shifted to either machine. The a.c. instrument and the synchronoscope are mounted on a swinging bracket. It might be said that owing to the sluggishness of the governors on the engines it is almost impossible to synchronize the two alternators, and up to the present it has not been done except when they have been changing from one machine to another, and then for only a few moments.

There are three circuits starting from the power-house —one to the fan-house, one to the tipple and coal-loader, and one to the village. The circuit to the fan-house is 2300 volts, stepped down to 440 volts by means of three 50 kw. transformers delta connected, thus permitting a continuous operation in case of the failure of one of the transformers. The fans are driven by a 75 h.p. motor having 900 r.p.m., manufactured by the Canadian General Electric Co., belt connected to the fan and situated at the mouth of the drift shaft and operated continuously, maintaining an air pressure of two and one-half inches.

In the marking house there is a 75 h.p. motor of the same type and speed as used on the fan. As the cars leave the tipple they are switched by gravity to the elevating track; a link chain with a prong catches each car and elevates it to the top of the grade, when by its own weight it runs to the mouth of the shaft and is hauled by horses into the mine.

The coal is conveyed from the tipple to the picking table by means of a conveyor belt 36 inches wide and 150 feet long, and is then dumped on a shaker screen and the coal picker then takes out whatever shale and other impurity there may be in it. When they load gondola cars the coal is dumped directly in the car without the aid of a loader, but when they load in a box car they have a Christie box car loader. The coal is dumped on a moving belt, which is placed lengthwise to the car, and the speed of this belt is fast enough to allow the coal to be thrown to the far end of the car when operating at full speed, and by reversing it the other end of the car is filled. It takes four minutes to spot a car and load it with this loader. This loader is operated by a 50 h.p. variable speed Western Electric motor.

The circuit to the Tipple is of the same general type as the one to the fan-house, and has three 50 kw. transformers delta connected.

There is also a small coal conveyor to convey coal from the track to the boiler house; it is operated by a Canadian General Electric 5-h.p. motor.

The circuit to the village, which is about one mile long, is a 2300-volt circuit, and the local distribution is made at 110-220 volts.

All the electrical work has been done in a good, workmanlike manner. Mr. Charles Wills is the electrician, and Mr. Jos. Verdun the master mechanic.

The value of service as it affects the relations between private operating companies and their customers

By H. H. Scott*

In recent years we have seen the creation of many holding companies in connection with public utilities, but the true course of the movement is not generally appreciated by the public. The public does not realize that all gas and electric companies grow even much more rapidly than the communities they serve, and that for each one dollar of gross revenue increase, five dollars or more of capital must be provided, when averaged over a period of years. If all the net earnings of the companies are expended for extensions and betterments, they would not be anywhere near sufficient to keep up with the ordinary unaccelerated growth of the average gas and electric company.

The usual way to provide capital for construction expenditure is to create a mortgage upon the property and issue bonds for 75 to 85 per cent. of the cost of the betterments. The conditions in the mortgage are generally made by the purchasers of the first bonds, but on the whole the conditions of the mortgages throughout this country are practically uniform.

Up to the present time, public utility bonds have been purchased and sold largely through bond houses located in the larger cities. The cost of handling and marketing bonds does not vary with the size of the issue, and therefore these houses seldom care to consider the purchase of issues in cities of 20,000 people or less. The result has been that the owners of the utilities in the smaller cities have found it extremely difficult to finance the growth of their properties, and have, in many cases, been obliged to sell their properties to holding companies or others who could finance the extensions.

It is because of the inability to finance small propositions that we are witnessing the grouping of numbers of pro-

*In N. E. L. A. Bulletin.

perties in the same localities. Of course, there is an economic advantage in this grouping of properties, but it is secondary to the financial consideration.

The growth of the gas and electrical businesses in the future depends largely upon the ability to raise the monies necessary to finance the extensions, and any move made to make the task any more difficult simply reacts upon both the companies and the public.

It is a fact that the public is more interested in the ability of public utility companies to keep pace with the growth of the communities and to render good service than in the rate of service. It is the writer's opinion that public utility stockholders and employees should thoroughly appreciate the meaning of service, and never fail to take advantage of an opportunity to present the facts.

Returning Prosperity already casting its Shadow in Western Canada

	Bu. 1915	Bu. 1914
Wheat inspected to date ..	108,226,900	51,483,000
In store at country points.	34,400,000	20,740,000
In transit not inspected....	8,400,000	1,725,000
Allowed for seed, feed and country mills	35,000,000	
Balance in farmers' hands to market	121,203,100	30,127,000
Oats inspected to date ...	16,000,000	11,142,000
Barley inspected to date ..	3,400,000	1,929,300

Haven't Taken the Trouble

Central station officers have been at fault in that they have not taken more trouble to thoroughly post their employees to be able to talk on the financial side of the business. As regards the physical side, the central stations have been quick to adopt almost everything practically good which might better the service. The central station business has attracted to its service men above the average in intelligence, for it is a fact that approximately fifty per cent. of the electrical engineering graduates of our technical universities and colleges enter its employ. The growth in numbers of the college graduates has also been very marked in the last ten years, and therefore the number of college men engaged in the business is very large.

Upon the whole, the employees are ambitious and progressive. Many companies have employees' clubs where technical, accounting, commercial and practical questions are discussed and solved, but, in the opinion of the writer, the most important question has not received the consideration it so thoroughly deserves, viz.: the thorough education of every employee concerning the financial and corporate matters of his company.

As it stands now, the man or few men in most companies who are competent to discuss these questions do not come into personal contact with their consumers, and, if they do, fail to meet the class of consumers which criticizes the most.

The employees, however, are continually in contact with all classes of people, and it is their duty to be courteous and competent to discuss all questions concerning their company.

This education becomes all the more important when we consider that the poorest paid employees of the companies, as a rule, come into contact with the consumers more frequently than those higher paid. There can be no question but that our meter-readers and office clerks meet and talk with more people than do the general managers. It is undoubtedly the belief of many consumers in every community that the particular public utility serving that locality is largely over-capitalized. If it is not true, shouldn't our employees be taught to courteously defend the company?

The early pioneers in the public utility business had only a faint conception of what the growth of the business would be, and the enormous amount of capital that would consequently be required. As a result, inadequate mortgages were placed on the properties and the total issues were exhausted long before the maturities. Because of this experience, in many cases what appear to be very large bond issues have been created. The public does not understand the reasons because it does not know the conditions incorporated in the mortgages for taking down additional bonds, and that interest is paid only on bonds that become outstanding. Nor does the public realize that the failure to create the large issue originally has added a very considerable factor to one of the items that go to make up the cost of service, viz.: the cost of money.

Many things that seem vague and technical in connection with the electric light and power business could be easily explained by our employees if the presidents, general managers and attorneys for the companies would take the trouble to spend about twelve hours each year in talking to the employees.

The public utility companies are selling a service—not a commodity. We are not selling kilowatt hours, and our employees should, above everyone else, be made to thoroughly understand this fact.

The writer believes in the men who are engaged in the public utility business. He believes they have contributed no small part to the development of the wealth and happiness of the people, and that, if not handicapped unjustly in the future, they will even contribute a greater share toward the development and utilization of the vast resources of this country. If we believe in our business, and if we know we are right, we can justify our position provided we accept the means at our disposal to educate the public.

Must Await his Turn

Druggist Bull—Just in a minute, Sammy, just as soon as I gives this 'ere gent 'is straffing drops.

(Reproduced by courtesy of the Toronto World)

In the Public Eye

A Budget of Comment on Men and Things of Moment Served Without Party Sauce

Mr. D. A. Thomas, representative of Lloyd George, British Minister of Munitions, has left us—with a rather bad taste in our mouths. To be sure he has straightened out the "shell game," paved the way for the reorganization of the shell committee and arranged that in future all purchases of munitions shall receive the direct attention of Lloyd George, whose representative in this country shall be Mr. Lionel Hichens, former head of the Cammell Laird Company. Mr. Thomas has also assured us that we are a great people with a great country, and that while the Shell Committee may have charged the Mother Land more for shells than they could be bought for across the line, Canada is perhaps entitled to the preference. Despite this diplomatic language, however, Mr. Thomas took the necessary steps to ensure an early cessation of the preference.

* * *

But if it is Mr. Thomas' good fortune to leave us with words of cheer on his lips and an openly expressed wish to let the "dead past bury its dead" so far as past sins are concerned, it is perhaps well not to give all the credit to one man that now the Empire is to get a dollar's worth of shell for a dollar from the most loyal of her sons. Since everything is being hushed up and the Shell Committee is being quietly and decently buried, it is impossible to get statements under oath. But private information from the seat of trouble indicates that Mr. F. P. Jones, manager of the Canada Cement Company, has much to do with the upheaval that sent Mr. Thomas home happy and the Canadian Shell Committee into permanent retirement.

Mr. Jones, like many another, went to Ottawa with a tender for shells. When the contracts were let they went as usual to the favored few, and Mr. Jones was not one of them. Those contracts were let at prices lower than previous contracts, but higher than Mr. Jones' tender. Unlike many another, Mr. Jones did not throw up his hands and go home. Instead he went straight to Sir Robert Borden. The Premier was not inclined to listen to a disappointed tenderer, but when Mr. Jones turned to the door with a decisive "Very well, I'll give my statement to the press," he was invited to call again in a couple of days. On the second visit he found Mr. Thomas with the Premier. Mr. Jones sat down at the typewriter and made three copies of his statement, one for the Premier, one for Mr. Thomas and the third he kept. That statement showed that the contracts let by the Committee were just $21,000,000 higher than if awarded at the rate of Mr. Jones' tender. A cable to England stopped the contracts before they had been approved by Lloyd George. And in future all contracts for munitions will be open to competitive bids.

* * *

Of course, explanations were in order, and they were made. It was pointed out that certain concerns had taken risks when shell making was an experiment that might prove costly to the makers and these concerns were entitled to consideration. And probably they were. The earlier price charged the Empire was $5.15 for machining a dollar's worth of shell. This was later reduced to $2.90 for doing the same dollar's worth of work. At these figures one would naturally conclude that it was the Empire and not the experimenter, or rather contractor, which was entitled to any consideration that was going. Again it was pointed out that policy demanded that the contracts be spread around so as to help relieve commercial depression brought on by the war. And it is only fair to add that this policy has been more or less successful.

* * *

But while it may be policy at this time of stress to smooth matters over so that the fight for the freedom of the world may be successfully carried on, suspicions have been aroused that cannot be set at rest by simply inaugurating a new system of purchasing munitions. Mr. Thomas may diplomatically suggest that "public sentiment will be met by the retirement of the manufacturing members of the committee," but he knows, and all Canada knows, that such action will stimulate suspicion rather than meet public sentiment. Everybody has heard of manufacturers who have wanted to tender on shells and who were not permitted to even see the specifications; of manufacturers who failing in their attempts to make headway at Ottawa have on their return home been offered contracts by middlemen; of at least one patriotic manufacturer who offered to make shells at cost and who was never given a chance. All this has been borne with an equanimity born of long experience with politicians and high financiers.

* * *

But in this case a much larger issue than mere money is involved. The Shell Committee was appointed by the Government, was representative of the Government and consequently representative of Canada. In so far as our dealings with the British Munitions Board is concerned that Committee was Canada. And in this great war, which Lloyd George has said is a war of munitions rather than men, shall it be said that when the Empire called for aid, when the brave men in the trenches shouted for munitions, Canada rushed to their aid with $1 worth of shell in one hand while the other was held out for $5.15? Shall it be said that while we are wont to twit the United Statesers with their fondness for the dollar our own country has outdone them in the hour of the Empire's peril? It is unjust that Canada should be allowed to rest under any such stigma; it is unjust that the manufacturing members of the Shell Committee should be retired under suspicion of having placed such stigma on their native land. In justice to those men and in justice to Canada the shell contracts and the Shell Committee should be given the fullest and most searching investigation. Neither should that investigation be held before any white-washing parliamentary committee. It should be held before a court free from party bias and interested only in bringing out the real facts. In this way and this way only can Canada's name be cleared and the Committee given its opportunity to absolve itself of suspicions that cling to it and will continue to cling so long as efforts are being put forth to cover up its actions.

* * *

To the Empire in her hour of need Canada has given freely of her substance and her sons. She has gloried in the opportunity to prove that her relations

toward the motherland were those of a partner rather than a dependent. From the Atlantic to the Pacific Canadians have voiced but one sentiment: that the Dominion must spend her last dollar and her last drop of blood to preserve those liberties guaranteed by the Union Jack and to crush the militarism that threatens the freedom of the world. That is the true Canadian spirit and behind it are united even those who mocked at the German peril and caviled over expenditures towards increasing Britain's naval power. If a few individuals have found, in the nation's hour of stress, their opportunity to make financial gains, all Canada should know it and all the world should be shown that they do not for one instant represent Canada's attitude towards the Motherland.

That Sir Robert Borden expected more from his shell committee goes without saying. It is whispered that in the interview with F. P. Jones, the Premier scoffed at the idea that shells could be produced at the price quoted in Mr. Jones' tenders. But when the latter came back by posting a marked cheque so large that it left no room for argument the days of the then Shell Committee were numbered. And recent Ottawa despatches indicate that Mr. Jones has gathered in about $7,000,000 worth of these new contracts. Also he has the satisfaction of having been a real benefactor to Canada and to the Empire.

* * *

I would not like to go so far as to place some leading Liberal journals in the traitor class, it is rather amusing to contrast their present ebullitions of patriotism with their utterances of a few short months ago. When Premier Borden came back from England, declared the German peril real, and asked parliament to make a cool appropriation of $35,000,000 to the British navy, he doubtless knew that war was imminent. He also doubtless imparted this information to Sir Wilfred Laurier. But did the man who thumps his chest and claims "a British subject I was born," etc., rise to the occasion and give a practical demonstration of his patriotism? On the contrary he opposed the appropriation in the House and strangled it with his Liberal majority in the Senate. And the while these ultra-loyal Liberal journals shouted their applause. Now they jump to the other extreme and are madly impatient because the Government is not equipping soldiers fast enough and is not furnishing more troops than the Mother country asks us for. It pains me to say it, but one cannot help wondering whether this is pure patriotism or if it is not mixed with a slight desire to embarrass the Government and make political capital for use in elections.

* * *

The French Commercial Commission, which has just arrived in New York, will spend a cool billion for machinery, war supplies and foodstuffs. Will the Minister of Commerce kindly tell us what steps are being taken to ensure that Canada gets her share of this business?

* * *

And it is something more than a rough guess that the practical politicians had a finger or two in the shell game. It will be noticed that the shell committee was made up of a harmless board of a couple of manufacturers and a batch of government employees. The manufacturing members would probably not be too inquisitive as long as certain factories got their share of the contracts and the government employees could be depended on to do pretty much as they were told. With this combination, a certain secrecy and an expressed desire to spread the contracts so as to cover a commercial depression caused by the war, it was an easy matter to place the contracts where they would do the most good. Most of those contracts were given to the little fellows. Men with big propositions were given no encouragement at Ottawa. One responsible man who made a proposition to enlarge and equip an already large factory and turn out shells in quantities was turned down cold. And meantime from Ottawa itself emanated the cry "Big contracts for shells are being given to the United States firms. Why can't Canada get more of them?" Now people are asking if this cry was started simply to cover up the fact that all orders were being parcelled out among the favored few who were receiving from $2.90 to $5.15 for machining a dollar's worth of shell. Anyway, just as soon as the British Munitions Board was assured of sufficient quantities of shells at reasonable prices we find half a billion dollars of contracts being talked of for Canada. Somebody apparently has a lot of explaining to do.

* * *

The secrecy observed by the Shell Committee in regard to contracts would be amusing were it not tied up with conditions that bring the blush of shame to every Canadian cheek. Prominent manufacturers who wished to tender on shells were not even allowed to see the plans and specifications. A reputable Canadian trade paper that wrote to the department for the plans was not only given a curt refusal but was told that the committee considered it inadvisable that anything should be published concerning them. And at the same time there was right in Montreal a German representative of a United States trade publication, who not only had full plans and specifications of those shells but all information concerning them. Was it the policy of the committee that it mattered not who possessed this information so long as it did not reach manufacturers who might possibly put in tenders?

* * *

The purchase of shell boxes was another of the duties of this now famous shell committee. Naturally you would expect them to follow the same policy in regard to the boxes. And you won't be disappointed. There was the same secrecy, the same spreading out of contracts to cover commercial or political depression, and the same awarding of contracts to the little fellows regardless of their equipment or financial capacity. That one of the largest box factories in Canada received a contract for 25,000 boxes and manufactured on a sub-contract 50,000 boxes more is eloquent evidence of the business acumen exercised in carrying on this branch of the business. That a Montreal firm not in the box making trade was awarded a contract which it sublet to a box manufacturer in the same city is further evidence that if the committee was honest it was incompetent. That a company of low financial standing was able to secure a large contract, even though it had to construct a new plant for the work, would indicate that the government—for this shell committee stood for the government—had poor relations whose exigencies gave it greater concern than the exigencies of the Empire.

* * *

The Purchasing Committee is another of our war institutions that is at present staggering along under a sharp fusilade of criticism. It is an eminently re-

spectable body and, in the opinion of many who have watched its workings closely, is doing its best under the conditions. It is composed of Geo. F. Galt, a wholesale grocer of Winnipeg; A. Laporte, French-Canadian wholesale grocer of Montreal, and Hon. A. E. Kemp, Member of the Dominion Cabinet, without portfolio, Toronto, manufacturer of tinware, and politician. It is said that Mr. Kemp leaves most of the actual work of the Committee to Messrs. Galt and Laporte. But here again that scattering of contracts to cover that same commercial depression creeps in and brings forth the usual criticism. The segregation of tenders thus rendered necessary often practically wipes out competition and the net result is that the big concerns are often neglected while many a sweat shop with a machine hastily stuck in a cellar is working night and day to turn out materials that do not keep the equipment up to the requirements of enlistment. Some of the big concerns are prepared to take this work at actual cost in order to keep their factories running and their staffs together. But the system in vogue does not give them a chance.

* * *

But the strongest criticism offered is that while the committee award the contracts the general business therewith is in the hands of the officials of the department. Just an instance to show how this works out. One call for tenders for a contract amounting to between $75,000 and $100,000 was issued that left but two clear days for figuring. As it was necessary to get in touch with the mills regarding necessary materials some of the biggest concerns in the country did not attempt to put in a tender. The trick of holding back specifications, on occasion, is an old one.

* * *

It was the duty of Sir Robert Borden to see that the Shell Committee, which was to have the handling of millions in contracts, was composed of men in whom the public could place the utmost confidence. What could he expect but suspicion when he appointed as that committee a manufacturer of shell making machinery, two seekers after shell contracts and a bunch of government employees? There were competent men in Canada, men with the necessary experience and business ability and who are not in line for contracts who could have been secured for the work. Why did not Sir Robert appoint them? On whose advice did he make his selections?

* * *

When Britain was placing large orders for shells in the United States and Canadians were asking why parts of these orders were not placed in Canada, why was it that big manufacturers could get neither orders nor information concerning orders?

* * *

At the request of Sir Robert Borden, Mr. F. P. Jones, of the Canada Cement Corporation, has come forward with a sort of blanket denial of the story of his interview with the Premier re the shell game. According to Mr. Jones' statement, Mr. Thomas was not present at that interview, nor did he threaten to make a statement to the press if his tenders were not given proper consideration. He admits, however, that Sir Robert sent him to Mr. Thomas, and to ensure him due consideration in that quarter called up Lloyd George's representative and arranged the interview. In a note to the Ottawa Citizen Mr. Jones further states that at the interview arranged by the Premier Mr. Thomas informed him that tenders would be called for.

* * *

It would appear from the above that Mr. Jones is not taking the public entirely into his confidence. He neglects to mention why it was necessary to call on the Premier and later attend a Premier-arranged interview with Mr. Thomas in order to acquire the valuable information that tenders for shells would be called for.

* * *

He also neglects to mention whether he had first been to the Shell Committee with his proposition. Of course, if he had, it might be necessary to further explain why it was necessary to go to either Sir Robert Borden or Mr. Thomas in search of such valuable information as he received. Were not the Shell Committee representing Canada in regard to the purchase of shells? Were they not giving out information in regard to the asking for tenders? Were they not using their every endeavor and their undoubted business ability to secure for the Empire the munitions she needed and in the cheapest market? Apparently not, for Mr. Jones, according to his own statement, had to go first to the Premier and then to Mr. Thomas before he could discover that tenders were to be asked for. But please note the grateful sequel: "Our company again tendered, and, I am pleased to say, got business at the prices tendered by us."

* * *

Those little words "again tendered," are an indication that previous to his interviews with Sir Robert and Mr. Thomas his company had been in the field for shell contracts. Why doesn't Mr. Jones go a little further and tell the public why his other tenders had been turned down, and why he found it necessary to go over the heads of the Shell Committee before his tenders received the consideration they merited, and his factories the orders subsequent events show they were entitled to?

* * *

Mr. Jones also makes a rather complicated denial of the statement that contracts had been let at prices higher than those quoted in his tender. Let me quote the extract from his note. "The article states: 'Shell contracts were let at prices higher than those tendered by the company which I represent.' As far as I know this is not correct. When we first tendered I believe no orders were placed."

It is easy to believe that the orders had not been placed when Mr. Jones first tendered. But from his own statement it is quite evident that this tender was turned down. Neither were the orders placed before his second tender went in, after his two momentous interviews. But will Mr. Jones deny that before those interviews tenders had been accepted by the Shell Committee and sent on to Lloyd George for approval? Of course, no orders could be placed till the British Minister of Munitions approved. And will Mr. Jones deny that he is now making part of those munitions at a price lower than the tenders accepted by the Shell Committee?

* * *

Blanket denials are not explanations, and it is explanations that are in order at the present time. Mr. Thomas has stated that "profits of the manufacturers have been higher than they were entitled to"; the Shell Committee has been allowed to drift into oblivion, and evidently requested to do its drifting with

the least possible noise; it has been replaced by a Munitions Committee, which is in the hands, and evidently under the complete control, of Mr. Lionel Hichens, who has come out from England as the personal representative of Lloyd George. What does this all mean? Why, if the story told in this column is not true, was the Shell Committee abolished? Why does Lloyd George find it necessary to send a man to Canada to boss the job? Why is Mr. Jones unable to get a contract till he calls on Premier Borden and Mr. Thomas, neither of whom has the power to award contracts, and "again" tenders? In short, if the Contract Record is wrong what is the right of our story?

* * *

This column admitted on the start that it was impossible to get sworn statements. It is so still. Consequently, it is impossible to be exact as to details. But the essentials of the story of the breaking up of the shell game have yet to be denied. The interviews between Mr. Jones, Sir Robert Borden and Mr. Thomas took place. They were followed by the disappearance of the Shell Committee. A report was sent out from Ottawa that all munition contracts had been cancelled. A competitive system of tendering replaced the old haphazard system. And big firms got contracts who had not been able to get even information concerning them before.

* * *

It is in no spirit of cavilling criticism that those facts are presented to the public. This column has no political axe to grind. It wants neither a contract nor an honorary colonelcy. But it would like to see the factories of Canada as busy as thorough organization to meet the demands of the Empire could make them. Britain is spending one hundred million dollars a week in the United States. She is spending twenty-four millions a month in Canada. Some people may figure from this that Canada is getting her fair proportion, and if you like to figure negroes of the south, the hyphenated Germans of the east and the Austrians and Hungarians of the middle west as "population" of the republic, perhaps they are right. But, as Mr. Thomas states, Canada is entitled to a slight preference. This preference should not show in the prices, but in the placing of orders, provided prices and goods are the equal of those that can be purchased elsewhere.

* * *

There is not the slightest doubt but that if the industries of Canada were organized or mobilized, and their output ascertained, that every factory capable of turning out munitions could be kept running night and day. Canada might just as well be furnishing the Empire with fifty millions of munitions a month as the twenty-four millions she is turning out now.

* * *

But did the Government make any endeavor to organize Canadian industries? On the contrary they turned the whole matter over to the famous Shell Committee, who formed a new family compact, discouraged manufacturers and so conducted things generally that David Lloyd George adopted as his motto "Put not your faith in Canadians," and sent a man over from England to do such buying as would keep the Dominion from becoming peevish.

* * *

Brig.-Gen. Bertram has come forward with an excuse for the fearful and wonderful way in which shell box contracts have been awarded. And like many another the Brigadier has shown a bravery that could be utilized at the front rather than a wisdom that can be used in council. His first words show that he either has been given a job too big for him or that he has something which it would not be politic to expose to the rude gaze of the public. "We have to deal with millions of dollars worth of orders," he exclaims, "and some three hundred and fifty or more manufacturing concerns. It is not to be wondered at if some company or some middleman puts it over us occasionally." And this is his excuse for giving an order for shell boxes to a company whose business is the building of dams!

* * *

Surely Brig.-Gen. Bertram does not wish the public to understand that the Shell Committee hands out contracts to the lowest, or rather the favored, bidder, without enquiry as to the bidder's equipment, business, or other qualifications for carrying out the work. An excuse of that kind is too flimsy to do duty even for a government committee that was apparently responsible to nobody or anything but its own conscience—which turns out to be only a political conscience.

* * *

Brig.-Gen. Bertram's confession of the incompetency of the Shell Committee is full justification for its abolition. But the trouble is that the evil done by committees does not die with them. This one has by its actions retarded the supply of munitions to the Empire when it most needed them, and it has lent itself to the creation of an impression, both here and in England, that the Government of this Canada of ours, which is giving its sons by the hundred thousand to keep the old flag flying, still places politics before patriotism.

* * *

No, Lloyd George's son has not been made a colonel. According to reports he is full private in a Welsh regiment. Which shows that the British Munitions Ministry, unlike the Canadian Militia Department, is busier making munitions than colonels.

SEARCHLIGHT.

The annual general meeting of the stockholders of the Westbury Electric Light and Power Company, presided over by the president, Mr. H. A. Worby, indicates that the financial affairs of the company are in a healthy condition. Directors were elected for the ensuing year:—Messrs. H. A. Worby, R. C. Cowling, C. W. Allard, G. W. Paige, E. J. Planche, A. Cromwell, and C. M. MacRae. The following officers were re-elected for the ensuing year: president and general manager, H. A. Worby; vice-president and secretary-treasurer, G. W. Allard; assistant secretary, Miss Louisa Worby.

The Dealer and Contractor

The Ontario Electrical Contractors' Association and the Simcoe Situation—Provincial Committee actively alive to the general interests of the trade

We print below a letter from the president of the Electrical Dealers' and Contractors' Association of Ontario to Mr. Barber, president of the Simcoe Branch of the Retail Merchants' Association, in which Mr. Commeford sets forth the attitude of the Contractors' Association toward the situation in Simcoe town—a situation already outlined in earlier issues of the Electrical News. Apparently the contractors look upon the action of the Hydro Electric Power Commission of Ontario as entirely antagonistic to their interests and calculated to interfere seriously with a business which already, under existing conditions, offers all too few inducements to men of ability and capital. That the Ontario Commission should deliberately plan out such a scheme as has been suggested—namely, to antagonize and finally eliminate the electrical contractor, and with him the dealer and the jobber, seems unbelievable. Surely these men are among the best friends the Ontario Hydro movement has got. Surely, too, they are in a peculiarly favorable position to work with the Ontario Commission, to the advantage of the Commission quite as much as of the contractors. Just in so far as the policy of the Commission has failed to be one of co-operation with the contractor, one to raise the standard of his work and improve his working conditions, just so far we believe that policy is at fault. No one claims that conditions in the electrical contracting business are ideal, but everyone knows that a good foundation has been laid for better conditions, and the policy of the Ontario Commission might well have been directed toward construction rather than destruction, toward improving conditions rather than toward further chaos.

Mr. W. C. Barber,
President, Simcoe Branch,
The Retail Merchants' Association of Canada, Inc.
Simcoe, Ont.

Dear Mr. Barber,—

On behalf of the Electrical Dealers' and Contractors' Section of the Retail Merchants' Association of Canada, Incorporated, I desire to express to you, and through you to the members of the Simcoe Branch, our sincere thanks for the privilege of attending your recent meeting in Simcoe to place our case before your members, and for the sympathetic hearing accorded us at that meeting. We are deeply indebted to your Association, and especially to your Executive for the hearty co-operation and support extended to us.

At your meeting on November 23rd next I understand that the prices charged for electric work will again be considered, and we would ask that you explain to your members that we are not asking for anything that will be unfair to the merchants or any other citizens of Simcoe. We wish them to go thoroughly into the question, with all the information before them, and if, after reviewing the situation from the ground up, they are thoroughly convinced that our proposition is a fair one, and that the prices quoted by the Simcoe contractors are based only on cost of materials and labor, with a fair margin added for overhead expense and profit, then we ask, as fellow retailers, and fellow members of the Association, that your members extend to us in this difficulty their sympathy, co-operation and support.

I understand that the Simcoe contractors have submitted three quotations only, which will serve as a basis for discussion and investigation, and of course, if the basis used in these three is acceptable to your members, the local contractors would, I know, gladly attend a meeting where, under the supervision of a committee from your Association, of independent business men, they could fit this basis to as many specifications for different types of houses as may be deemed desirable. Our main desire is to convince every member of your Branch that the prices offered are fair, that they have been established in a fair manner, and when we have achieved this result we feel confident that we can count on the hearty and active support of your Association in steps to re-adjust the present unfair conditions existing in Simcoe.

I am sure your members realize that the principle upon which the Retail Merchants' Association is founded is to attain centralized and co-operative support in measures for mutual protection, and it is with this in mind that we have approached your body. I may say that the moral and financial support of our section is being freely extended to the parent body at the present time, while our section is entirely self-sustaining, and is of no expense to the Association, our expenses being taken care of out of the additional amount collected for our membership fees. As a consequence our support is being extended to all sections of the retail trade, and we are now asking for your moral support in return.

If the information before your members at your next meeting is not sufficiently comprehensive to convince all, then I shall deem it a favor if you will communicate with me, and I will arrange to procure whatever information is considered necessary. We believe that our case is so entirely fair and equitable, that we welcome investigation by any body of merchants, or any body of independent citizens. We are sure that it is the desire of your members to encourage local enterprise, and thus help to build up your town, and in order to do this it is imperative that these business men receive a price for their output which will enable them to meet their obligations, and yield a fair return on the money and time invested.

As explained to your members, we are all supporters of the Hydro movement, but we feel that in order for the Hydro to attain its due measure of success, it must have the working co-operation of all, and after our meeting in Simcoe, I feel that this co-operation is there for the asking. After discussing this matter with several of your members, there remains no doubt in my mind that in order to make the Hydro in Simcoe a success and put it on a paying basis, the Hydro Committee must first get the merchants behind

them, and I feel confident that if the Committee took the stand that the electrical contractors of this province are taking to-day, and came out fairly and squarely to explain what their requirements were, and what their plans were, it would not be long before they would have the entire community rallying to their support. In all our negotiations we welcome the most searching investigation, and we have such confidence in the justice of our position that we welcome the opportunity for public discussion. We know that we have a function to perform in the business life of this province, and we are convinced that we can perform that function more economically, and can render better service while doing it, than can be done by any governmental or municipal monopolistic plan.

While our prices may appear to be higher than those offered by the municipality, I would ask your members to consider this statement.—That there is no business transaction of this nature which does not entail a certain amount of overhead expense, and if this overhead expense is not provided for in the price collected, then it must be provided for from some other source, and in the case of the Hydro in Simcoe, we believe that it is these things which are making impossible a lower rate for current.

I would also ask you to consider this statement.—That 99 men out of 100 are willing to pay a fair price for anything they purchase, and that to you as merchants, the "greatest good to the greatest number" means the development of Simcoe as a Town, and the consequent development and enlargement of your sphere of operation.

Yours sincerely,
J. W. Commeford,
Provincial President.

Toronto, November 20, 1915.

Electrical Section Board of Trade

A committee was recently appointed by the executive of the Electrical Section of the Board of Trade, to arrange a series of monthly luncheons. The first of these luncheons was held on November 5th, when Mr. J. W. Purcell, of the Ontario Hydro Electric Power Commission, gave a very interesting talk on "The Extension and Uses of Hydro Power on the Farm." Though this meeting was called at very short notice, there was a good attendance of members, who all expressed themselves as having both enjoyed and profited by the meeting. It has since been decided to hold these luncheon meetings regularly on the first Thursday of each month. It is suggested that the members of the Section shall make it a point to reserve this date, as very interesting meetings are being arranged for, of which the topics and speakers will be arranged later.

The Electric on Hills

There is no question but that in certain quarters the impression has prevailed that the electric will not negotiate hills. Nothing could be further removed from fact. Not only will electric vehicles operate in a thoroughly satisfactory manner in hilly districts but they will travel up grades which the average gasoline car would not attempt.

Possibly the fact that the average gasoline car in order to get up a hill must race its motor and attack the grade with a flying start, maintaining an excessive speed in order to reach the top, gives some the impression that the gasoline car is better than the electric. However, it must be realized that the electric, if it were required, could take hills as relatively fast as does the gasoline car with its strain on the mechanism and woeful waste of energy. But the electric vehicle's action on a hill follows the practice of all natural locomotions. When arriving on a grade either a greater amount of energy has to be expended to maintain the pace pursued on the level or the speed must be reduced in proportion to the grade without using a disproportionate amount of energy. There are grades which many gasoline cars could not negotiate without a so-called flying start, although on these hills the average electric will start from a stationary position and will furthermore stop and even back and then continue up the hill at the will of the operator.

The following figures, taken from records of the Electrical Vehicle Association, indicate what is being done every day by one of their electric cars on grades as high as 20 per cent. The motor at 60 volts and 1200 r.p.m. draws 40 amperes.

On 5 per cent. grades their meters showed they were using 65 volts and a 75 ampere draw;

On 9 per cent. grades 62 volts and 80 amperes;
On 11 per cent. grades 55 volts and 125 amperes;
On 15 per cent. grades 43 volts and 132 amperes;
On 16 per cent. grades 43 volts and 140 amperes;
On 17 per cent. grades 42 volts and 145 amperes;
On 20 per cent. grades 42 volts and 170 amperes.

And here is another case:—

Car 1 ton capacity;
Motor 60 volt, 40 ampere, 1200 r.p.m.;
Battery 65 cells nickel-iron A-6;
Weight of car, loaded, 6760 pounds;
Weight of car, empty, 4990 pounds;
Weight of load carried, 1770 pounds;
Voltage and amperes draw at various grades were:—
On 1 per cent. grades 72 volts and 47 amperes;
On 5 per cent. grades 66 volts and 100 amperes;
On 13 per cent. grades 60 volts and 250 amperes;
On 15 per cent. grades 50 volts and 260 amperes;
On 18 per cent. grades 42 volts and 280 amperes.

Dern Yer, Come Out and Fight!

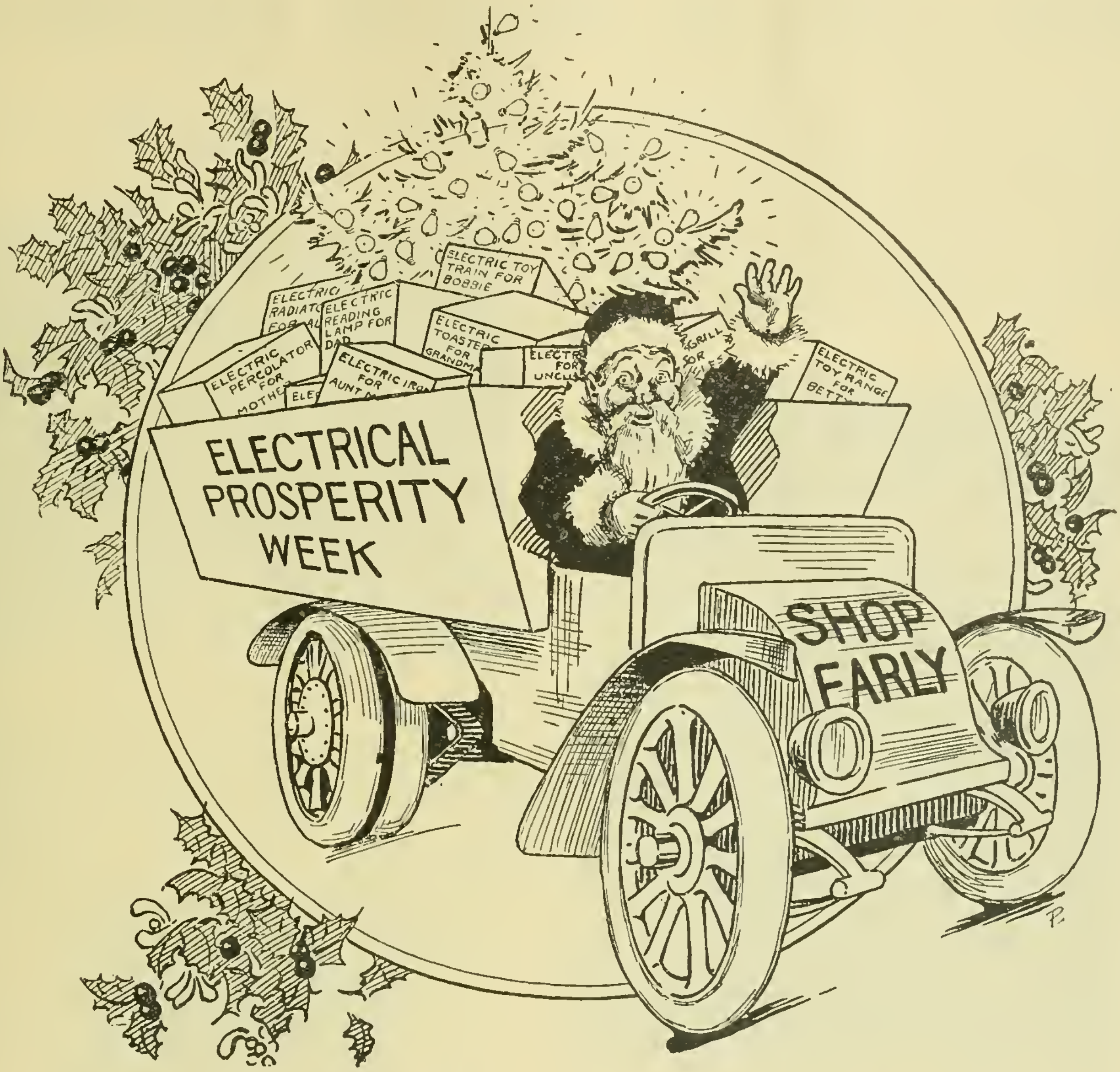
The front door is soundly timbered and safely locked. The small boy stands in the parlor, looks through the window to the streets, valiantly sticks his tongue out at the boy with the clenched fist on the sidewalk, and says, "Dern yer, come out and fight!"

How falls it that Americans, in awarding to the British the palm for imperviousness to the pricking point of wit, have managed to overlook the Teutonic cousin? The plate of British receptiveness to humor's flashing message is delicately sensitive when compared to that of Kultur's propagandists, who to-day, standing on the decks of sequestered ships, look out over the protecting mine fields and the beetling batteries of Heligoland, and send forth the challenge to the free roaming British sailorman, "Dern yer, come out and fight!"

War's humors usually are grim, but this last double-leaded, triple-columned tale of defiance which comes cabling and hurtling out from the safe recesses where the German Dreadnoughts and the German Donots at anchor lie, is as rollicking a thing as wit's recital ever gave to humor-loving eye or ear.

The sole sad thing about this story from the Teutonics' cloistered fleet is that its writer takes it so all-fired seriously and has such a child's faith that the world will be serious with him.

"Dern yer, come out and fight!"—Washington Times.



"Ho! For an Electrical Christmas!"

An attractive window card or background for the dealer who is planning to make use of electrical prosperity week to introduce his Christmas campaign. Wherever Santa Claus' secret hiding place may be he evidently keeps in touch with modern transportation methods and traffic rules.

New Books

Test Methods for Steam Power Plants—By Edward H. Tenney, B.A., M.E., the Van Nostrand Company, New York, publishers; price $2.50 net. This is a reference book for the use of power station engineers, superintendents and chemists. Highest economy in the modern steam power plant can be gained only through actual knowledge of the conditions existing throughout the station, both in regard to the materials used in the production of power and in the equipment itself. To keep in close touch with those factors which have the greatest bearing upon the economy of the station, requires a thorough knowledge not only of mechanical details, but also of certain elementary principles of physics and chemistry. The object of this book is to combine into one volume those methods of analysis which can be used to good advantage in the power plant and which will aid the power station engineer in keeping his costs of generation at the lowest possible figure. Well illustrated; 224 pages; size 5¼ in. by 7½ in.; leather bound, flexible cover.

Principles of Direct Current Machines—By Alex. S. Langsdorf, M.M.E.; McGraw-Hill Book Company, New York, publishers; price $3.00 net. This book has been prepared with the object of placing before junior and senior students of electrical engineering a reasonably complete treatment of the fundamental principles which underly the design and operation of all types of direct current machinery. At the end of each chapter useful, illustrated problems have been given which engineers would find it to advantage to work out. Well illustrated; 400 pages; 6 in. by 8¼ in.

What is New in Electrical Equipment

New Form of Moore Color-Matching Lamps

At a joint meeting of the Illuminating Engineering Society and the American Electrochemical Society, held in New York City on November 11, a new form of Moore tube embodying a new principle was described in detail and illustrated by showing the difference in the color values of objects, such as dress goods, silks, meat and flowers, when viewed first solely by the light of a standard tungsten lamp and then by the new type of Moore light. Spectrophotometric investigations that have been made prove that all

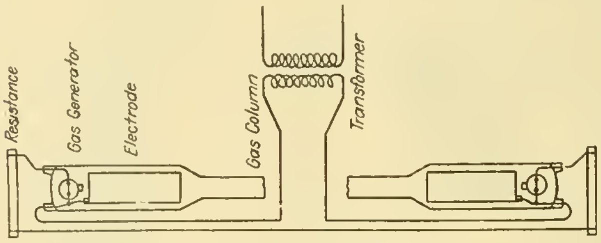


Diagram of new color-matching lamp.

articles when viewed by the light of the tube lamp have the same shades of color as they possess when viewed by the light of a clear sky.

The figure herewith shows a plan view of this new color-matching unit. The straight tube lamp is contained in an elongated sheet-metal case, which is provided with a screw base similar to that used on the larger sizes of incandescent lamps. Instead of the lamp being fed CO_2 gas by means of an electromagnetic feed valve, it is generated automatically within the tube itself. Near each electrode is placed a small bulb about an inch long, containing calcium carbonate, from which emanates CO_2 gas when the resistance wires imbedded in it became heated to exactly the proper degree by reason of their being connected in shunt to the gas column. The gas column is 0.875 inch in diameter and one foot long, and appears as a solid bar of light of intense whiteness. The foot-candles available near the tube are over 200, thereby making this apparatus suitable for the very closest color discriminations. The degree of vacuum is automatically held within 0.001 of a millimeter, and the apparatus will stand wide line-voltage fluctuations without becoming disarranged in any way. The lamp takes about 240 watts. The new lamp is being made by the Edison Lamp Works of General Electric Company, Harrison, N.J.

Transformer News

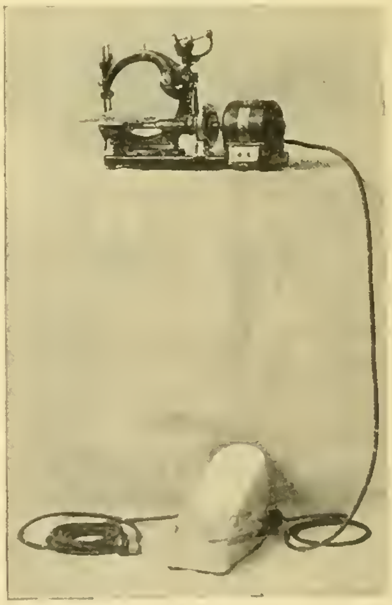
The use of toy transformers has spread widely in the last few years. This extended use has brought about some decided improvements in toy transformer construction. These improvements are found in the Thordarson toy transformer, which, for flexibility and protected operation is far in advance of anything heretofore sold. In toy transformer operation short circuits occur continually, due to the ignorance of the operator, bridging of the tracks when toy train is derailed, and many other causes over which the manufacturer has no control.

The Thordarson Electric Manufacturing Company has therefore provided its toy transformers with a device for effectively protecting the transformer itself from operating abuse, consequently minimizing repair expense. This device, to be absolute in its operation, must essentially be a part of the transformer, to protect it from other causes of derangement must be inherent in the transformer itself. Realizing this necessity, the Thordarson Company has placed within the transformer case its protective device. When the transformer is overloaded from whatever cause—either short circuits or unintentional overloads—this device automatically opens the transformer circuit, cutting same out of service. By means of a push button protruding through the side of the case, the transformer can be readily replaced in service after short circuit condition has been removed ,and then only, it being impossible to close the circuit until overload condition is removed. This feature is particularly important where the transformers are operated by children.

In order that the secondary voltage can be varied in steps of one volt, the Thordarson toy transformer is provided with a regulation switch and universal connection terminal placed upon the top of the transformer, where it is very convenient.

Sewing Machine Motor

A new type of motor for the Wilcox & Gibbs domestic sewing machines is being shown in operation at the New York Electrical Show in the Westinghouse Electric & Manufacturing Company's booth. The motor is smaller than those previously used and is equipped directly to the machine shaft without use of belts, brakes or friction drive. The speed of the motor, and hence of the needle, is under perfect control by the operator from a special foot pedal supplied with the motor. In this pedal there is a specially constructed resistance which has virtually an unlimited number of steps similar in principle to a slide wire resistance. This gives perfect speed control from zero up to 1,800 stitches per minute. However, as this speed is higher than practicable, an adjustable stop is provided so that the operator



may easily adjust the maximum speed to suit her own taste. Any speed from the maximum to one stitch at a time may be obtained. The acceleration is always smooth regardless of what speed is desired; there is no jerking, no breaking of threads. No brake is necessary because the motor very quickly comes to rest since the large flywheel required with foot power is not included in the drive. The motor is of the compensated universal type permitting it to be used on any 110 volt circuit from 25 to 133 cycles.

Electrically Operated Motion Signs on Trucks

A very unique method of advertising has been developed by the American Sugar Refining Company of New York, utilizing the large number of trucks their Brooklyn plant operates. Fifty of these trucks are now equipped and they plan to have about twenty-five more. There are three types of signs. No. 1, illustrated herewith, advertises Crystal Domino Granulated Sugar. This sign has a revolving disc which illustrates the sugar flowing from the carton to a bowl. Another sign shows the well-known "Little Miss

Crystal Domino" emptying a carton of Crystal Domino Sugar tablets into a sugar bowl. Around this sign is a revolving disc with spiral colored stripes which give a rainbow effect. The third sign advertises both granulated and tablet Crystal Domino Sugar. The picture of the carton of the tablet sugar appears. Then this picture disappears and the granulated sugar carton appears in its place. The mechanism of the signs is driven by a six-volt ball bearing motor, made by the Robbins & Meyers Company, Springfield, Ohio. The motor runs at 1000 r.p.m. and takes 10 amperes. A 120 ampere-hour lead battery supplies the current. The batteries are charged each night, twelve batteries being charged in series across 115 volt mains. Six sets of twelve charging receptacles are provided permitting 72 batteries to be charged at a time.

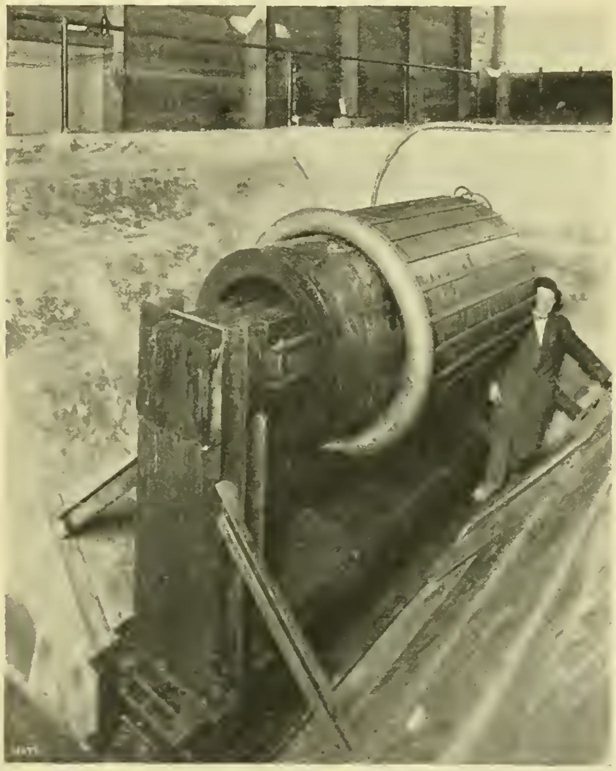
Million Volt Transformer Demonstrated at the Panama-Pacific International Exposition

By A. S. Lindstrom

The installation of a 1300 h.p., million volt transformer at the Panama-Pacific was completed November 1st. This transformer was designed and built in the laboratory of Mr. C. H. Thordarson, of Chicago, at a cost of $30,000. This cost includes the specially made machinery for winding the low tension coils and the insulating tube. It required a year and a half in the laboratory and when finally designed only thirty days building the same in the factory.

Final tests have been made on this transformer and arrangements for demonstrating a number of very high-voltage phenomena. The transformer is installed on a specially designed building erected by the Exposition at a cost of $6,000 and located to the east of Machinery Palace. There are no nails used in the construction, the structure being held together by iron bolts which run parallel to the high potential wires to avoid the danger of fire from the electric static stress. It has the appearance of a large Zeppelin hangar, as both ends are left open for ample clearance of the high voltage that lead to the structure outside of the building.

The transformer is submerged in 225 barrels of oil in a specially designed cement pit with metal lining. The air surface at the oil lines measures 16 x 18 feet. The weight of the transformer is approximately 30,000 lbs., and it is made up of 26,000 pieces of paper, fibre, aluminum, copper, steel and iron and designed to develop 1,000 kw., or a little over 1,300 h.p. at 60 cycles. Under ordinary conditions this transformer will develop 2,000 kw. for twenty-four hours. The low tension coils are wound to receive 2,200 volts and are made up of 122 coils arranged in multiple series, the coils being bridged in pairs across the 2200 volt terminal. This allows for a neutral tap which is grounded to the transformer frame. The paper tube which insulates the primary and secondary coils weighs over 2,600 pounds. The million-volt circuit is made up of 190 coils, each coil being 5,000 volts, equally spaced and wound with flat aluminum, 8 mil, 1 ampere conductor well insulated by paper. All coils are



Million volt transformer.

connected in series with one end grounded. There are 400 miles of paper, aluminum and copper used in the construction of the coils and paper tube, 90 miles of aluminum and 270 miles of paper being used in winding the million volt coil.

"The Triangle" is the name of a publication issued by the Westinghouse Agent-Jobbers Association, East Pittsburgh, Pa. The October issue, which has just made its appearance, has an attractive cover showing Niagara Falls, in honor of the recent meeting of the jobbers held at that point The magazine contains a number of articles with reference to the sale of electrical products and is well illustrated throughout with views of interest to the electrical profession.

The extension of the Montreal and Southern Counties Railway to Abbotsford will be in operation in a few days. The further extension to Granby is practically completed (a distance of 47 miles from Montreal), including the substation at Granby, and the company is waiting for the electrical equipment.

Mogul-Base Porcelain Socket

In refrigerating plants, abattoirs, steamships, etc., where corroding vapors are constantly present, a socket with a porcelain covering is more desirable than one having the standard brass shell. With these requirements in mind, together with the increasing use of type C, or gas-filled tungsten lamps, the firm of Harvey Hubbell, Inc., have designed a

new porcelain mogul-base socket, shown herewith, equipped with either three-eighth or one-half-inch aluminum caps as desired. A rubber gasket assures an absolutely tight joint between the upper and lower portions, making it thoroughly weather-proof and capable of withstanding the ravages of the elements. Long binding screws with generously proportioned heads greatly simplify the wiring, permitting ample room for the loop to mat and confining all stray wire ends.

System for Hospital Signal Lighting

The lighting system of a modern hospital is usually controlled from one or more distributing panelboards located on each floor. Branch circuits from these panels are run to the various rooms and the lighting of the individual rooms is controlled by a switch in the side wall. Separable flush receptacles are installed in each room as outlets for fans, heating pads, reading lamps and other electric portables.

Herewith is shown a diagram of a simple, inexpensive and efficient system which utilizes these standard circuits

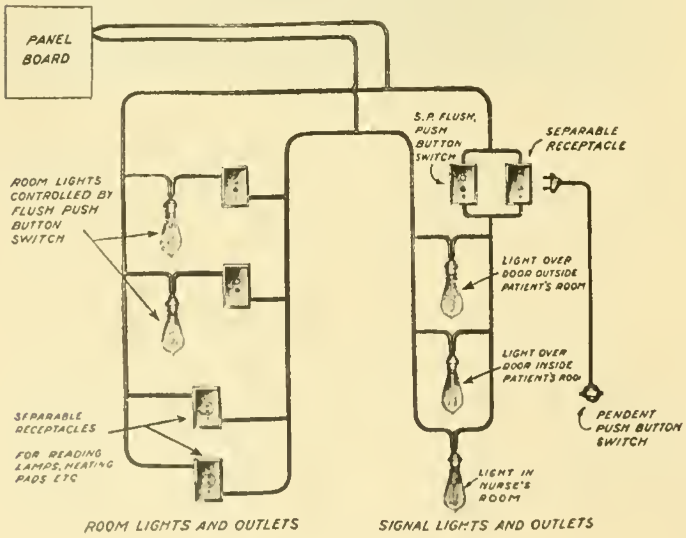


Diagram for hospital signal lighting.

and is installed so that a positive indicating signal can be readily given by the patient. A green light is placed over the door inside the patient's room, and over the door outside the patient's room a red light is installed. Inside the nurses' room is located a red light for each patient's room and a pendent switch is placed at a convenient location and within easy reach of the patient. This switch is connected in series with the line through a flush receptacle of the separable type.

When desiring to call a nurse, the patient pushes the switch button which lights the lamps inside and outside of the patient's door and the lamp in the nurses' room. These lamps will burn until the nurse visits the patient and turns them off at the pendent switch. In addition to the pendent-switch control, the system may also be operated by a push-button switch installed in the side wall.

If desired, a single-button lock-type push-button switch can be used in place of the pendent switch. This switch when operated by the patient is locked in the on position and it is necessary for the nurse to use a key to turn off the lights.

This system has been designed by the General Electric Company.

New Design of Phenixlite

The illustration shows a new design of the "Phenixlite" manufactured by McDonald & Willson, Limited, Toronto. It is especially designed for use with the high power nitrogen lamps, giving a soft, mellow light which is very efficient for all illuminating purposes. The upper shade acts as a reflector, taking the place of the ceiling. The lower portion

is a semi-indirect bowl of etched design, securely fastened to the upper portion by a specially patented holder, making the whole rigid and secure. The natural design of the Phenixlite affords ample ventilation, so essential for maximum results from all nitrogen lamps, and makes the whole fixture practically dust-proof.

Mr. Art. Boyes has been appointed sales manager of the Duncan Electrical Company, Limited, Montreal. Mr. Boyes has had a long experience in the electrical supply business, and was for six years associated with Dawson and Company, Limited, Montreal. One of the objects of Mr. Boyes' present appointment is to assist the jobbers in marketing the Duncan Company's productions.

The Volt, Unit of Electrical Pressure

Many electrical terms bear the names of pioneers in electrical research. Thus we have the watt, named after James Watt, the Scotch inventor; the "ampere," after the famous French scientist of that name; the volt, after the great Italian physicist Volta; and so on. How each of these great scientists contributed to the development of electricity is told in a series of interesting E-lecturettes prepared by the Society for Electrical Development. Number 1 tells of the volt, named after Allesandro Volta, as follows. Later issues of the Electrical News will contain brief E-lecturettes dealing with other everyday electrical terms.

The term volt (v) owes its name to Alessandro Volta, inventor of the electric battery. Volta was born at Como, Italy, February 18, 1745, in a house where the Volta family had lived for more than 300 years. When a child, strange as it may seem, he was very backward. He was thin and pale, and other little boys thought him dull, indeed. He was four years old when he spoke his first word, "no." From the time of this "event," however, his mind seemed to turn entirely to the wonders of nature. Many times as a child he almost lost his life in exploring caves and odd places where people never went. At sixteen he wrote poetry, and at seventeen he won prizes in philosophy. At eighteen the famous Abbe Nolet, impressed with the boy's knowledge, had him write essays on electricity for the great men of the day, because people knew very little about this mighty force in those times.

As a young man Volta went on long trips into other countries, and once in 1762 he met Benjamin Franklin. In London, Berlin and Paris he was given all the honors the world's great men received. The first consul founded the Volta prize, which was once conferred on Alexander Graham Bell, inventor of the telephone. Bonaparte gave Volta a sword and made him a senator of Lombardy. The emperor took the same kind of liking to Robert Fulton and gave Fulton 10,000 francs to help the Yankee to keep up on French soil his experiments with submarine boats. It is told of Bonaparte that he once visited the National Institute and found there a laurel wreath on a bronze tablet, on which were the words, "Au Grand Voltaire." The emperor erased the last three letters, thus making it read "To the Great Volta."

Volta really had nothing more to do with what is now called a volt than dozens of other men of science. Volta found out a lot of things electricity could do, but this was long before anybody dreamed that almost everything in the world can be run by electricity and before it was decided its power could be measured. It was when the scientists got together in later years and decided to give names to what they had learned about electricity that they picked out an electrical unit of pressure and called it a volt.

The fact that you can't pick up a chunk of electricity and hold it in your hand and poke it with your finger has stirred up a whole lot of mystery about what really now is a very simple thing.

One of the first things the fathers of electricity learned was that there is a force "from behind"—pressure—in electricity.

You get an idea of what is meant by pressure when you remember the garden hose playing over the lawn. When it only "half worked" and threw a stream only a little way you said it lacked "pressure." As the pressure was greater the hose "worked" better. This pressure was the power "back behind" in the water pipe. It is always there, but cannot show itself in action until you turn on the nozzle of the hose. Then it tries to escape, the power "back behind" pressing the water on and out. Electricity flows exactly the same way, except that you cannot see it, although you behold what it does. The second you "turn on" the switch the electricity flows; the power in the line is always there seeking to be free and at work.

Nowadays it is very simple to measure this electric pressure. So if you have a wire filled with electricity, instead of the garden hose filled with water, and want to make an electric vacuum cleaner go you will understand that you must have an electric current of just enough strength or pressure enough to make the little wheels turn and keep revolving. Nearly all house currents have 110 volts pressure.

A volt, then, is the pressure that is needed to force a current of electricity of a certain quantity through a wire of given resistance, or, to speak in scientific terms, a volt is the pressure required to force one ampere of current through a conductor having one ohm resistance.

Where Are Canadian Cleaners?

Under the heading "American Vacuum Cleaners in Canada," The Electrical Review publishes the following interesting item,—

"A noticeable feature of the furniture-store window displays in Kingston, Ont., is the prominence given to vacuum cleaners of American make. With the interruption of supplies from elsewhere American manufacturers have succeeded in establishing their cleaners on a firm footing there. There are to-day a dozen or more business houses selling them, besides several persons acting as individual agents.

"The outlook for this class of goods is encouraging. The demand is mostly for a moderate-priced, hand-operated machine, retailing for $12 to $15, but there is a sale of more expensive electrical machines also. This latter fact was illustrated by the recent experience of the manager of a large hardware store, who by working with a selected list of the firm's customers, sold twenty cleaners, after his corps of thirteen clerks had declared the price ($135) too high for the local trade."

Inspection of Electrical Signs

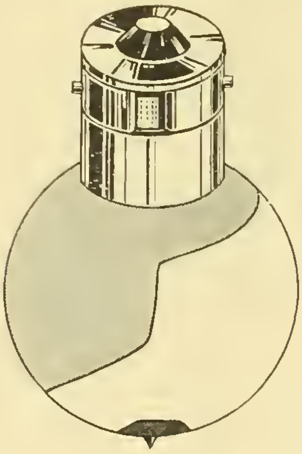
The Electrical Inspection Department of the Hydro Electric Power Commission of Ontario are notifying sign manufacturers that they will be required to provide themselves with labels which may be obtained from the commission at a nominal cost and which must be affixed to every sign that leaves their shops. The introduction of this label service will undoubtedly become more general in the province. Already the commission are requiring their label on service boxes, so that it is now almost impossible for substitutes to be used in Ontario in place of such designs as now conform with and are approved by the commission. The introduction of the label in connection with electrical signs will be in force very shortly, and sign manufacturers are advised to communicate with the Hydro Electric for full particulars.

Christmas Advertising

We have received inquiries as to where copies of the suggested Christmas folder shown on page 39 of our November 15 issue may best be obtained. If any of our dealer readers intend to make use of considerable quantities of these folders, and experience difficulty in getting them elsewhere, the Electrical News will endeavor to supply them. However, we would urge the wisdom of placing your orders, somewhere, at once; the last month before Christmas goes very quickly.

Kno-Glare Motor Lamp

The illustration herewith shows the Mac "Kno-Glare" swivel-bulb automobile lamp. The function of the lamp, as the name implies, is to do away with the confusing glare of the automobile headlight and at the same time give sufficient light for safe travel. The portion of the lamp treated in certain proportions and peculiar form, with a semi-translucent compound, being adjusted so as to be at the bottom



of the reflector, subdues light which would ordinarily be reflected upward causing the dazzling glare. The clear portion being at the top allows the light to strike the upper portion of the reflector and be directed downward on the road. The lamp is provided with a swivel base to allow of adjustment to the proper position. The entire sales of this new equipment are being controlled by A. Hall Berry, 97 to 101 Warren Street, New York.

Spielmann Agencies, Montreal, state that present conditions have compelled them to disappoint their customers for Griffiths Bros.' Ohmaline black insulating varnish, but that the manufacturers have been so busy with Government work that Canadian requirements have had to stand on one side. The Admiralty have recently ordered thousands of gallons for their dock-yards, and greater quantities have been required in other plants for Government work. They state, however, that they are promised a consignment of Ohmaline on the next boat from London, and preference will be given to their regular customers.

The firm of J. Everard Myers, electrical contractor, have been awarded the complete equipment of the electric conduit and wiring installation for the new east end power station; following the usual practice, the Hydro union rate of wages will be paid.

Owing to increased business during 1915 the Canadian Ever Ready Works of Toronto announce that they will move to larger premises at 263-265 Adelaide Street West on or about January 1st, 1916.

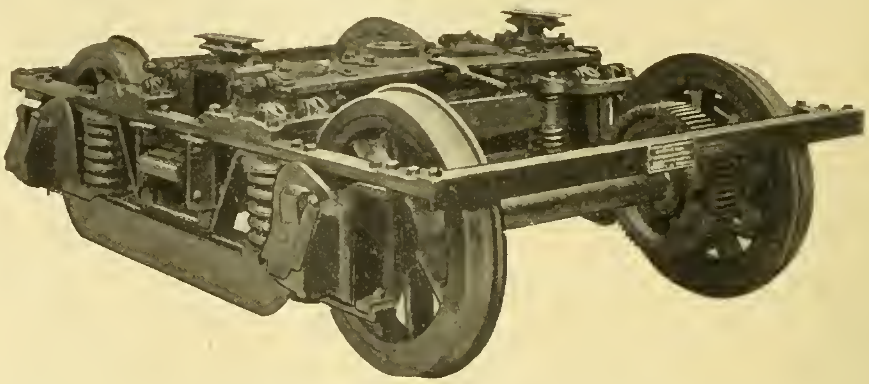
Mr. George M. Wight, managing director of the Monarch Electric Company, Limited, St. Lambert, P. Q., has been elected an alderman of the St. Lambert Council.

The National Board of Fire Underwriters are distributing copies of the 1915 National Electrical Code Regulations for electric wiring and apparatus.

The Perkins Electric Company have registered in Quebec, headquarters Montreal.

Canadian "Baldwin" Trucks

The Canadian Locomotive Company, Limited, of Kingston, Ont., are now controlling the manufacture of Baldwin trucks for the Dominion of Canada. The illustration herewith shows a Class 84-30-AA type, of which some thirteen were recently supplied to the Lake Erie and Northern Railway Company for use on their interurban service. This truck is designed for high speed, and has a rated carrying



Type of truck supplied Lake Erie and Northern Railway.

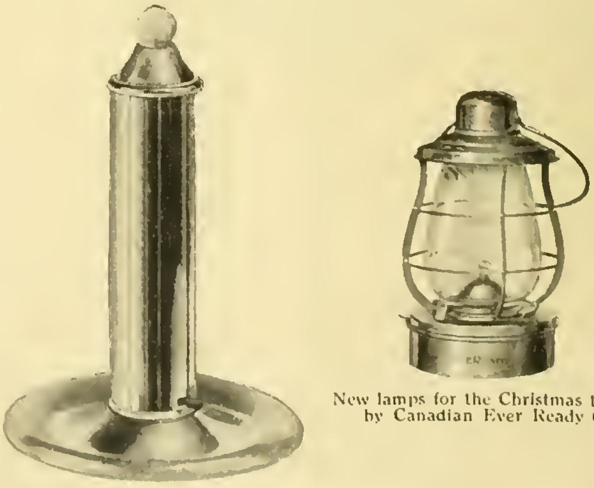
capacity of 30,000 lbs. on the centre plate. It is provided with frictional side bearings and is of the equalized pedestal type. The Canadian Baldwin trucks apparently solve the problem of minimum weight, economical maintenance, simple construction, noiseless operation, and easy riding qualities.

Personal

Mr. E. R. Shirley, B.A., B.Sc., who recently resigned his position as electrical superintendent for the Canadian Exploration Company, Limited, at Naughton, Ont., has been appointed power house superintendent for the Laurentian Power Company, Limited, at their new plant at Seven Falls Development on the Ste. Anne River near Beaupre, Que.

Mr. Paul M. Lincoln, whose term as president of the American Institute of Electrical Engineers, expired July 1st, 1915, and who has for a number of years been prominently identified with the engineering department of the Westinghouse Electric & Manufacturing Company, has resigned his position with this company in order to devote his time to the manufacture of a meter which he has recently invented.

Mr. Henry Remey, for many years chief electrical engineer for the Prescott Electric Light and Power System, municipally owned, died at his home in Prescott on November 3.



New lamps for the Christmas trade—by Canadian Ever Ready Co.

Current News and Notes

Agincourt, Ont.

It is expected that this village will be supplied with electric light and power from the lines of the Hydro Commission, which already reach as far as David Duncan's farm on the C. N. R. line. Agincourt is less than five miles from this point.

Bathurst, N.B.

The New Brunswick Telephone Company are installing two new circuits between this point and Newcastle, thereby doubling their capacity.

Brockville, Ont.

The central energy system was opened in this city in their new building by the Bell Telephone Company on Friday, November 19.

Edmonton, Alta.

The estimated cost of the scheme of the Edmonton Power Company is $7,500,000, including $1,500,000 the cost of an electric inter-urban railway from Edmonton to the proposed power site just below Rocky Rapids, on the North Saskatchewan River. The estimate for the hydro-electric scheme was made by Sir John Jackson, Limited, the English contractors. The preliminary plans show a dam 1,500 feet long and 100 feet high, forming an artificial lake sixty miles in area. The complete scheme will take at least five years to complete, and under the terms of the agreement the company is prepared to make with the city, the company will take over and operate the present city steam plant, selling current at 1.3 cents, the city to pay the capital charges, but the company to pay for improvements during five years. For three years engineers have been investigating the scheme, making tests, borings, soundings, etc. Mr. R. S. Kelsch, Montreal, is the consulting engineer. On Monday, November 22, the citizens voted on a by-law authorizing the city to enter into an agreement with the company. The result in favor of the by-law was 8,153 against 5,179.

Fredericton, N.B.

It is reported that Mr. Jos. Hawkins, of Douglas, N. B., has made arrangements to develop Nashwaaksis Falls to the extent of 75 h.p., and that he will remove his mill to that point. In all probability arrangements will also be made for lighting Nashwaaksis village.

Goderich, Ont.

It is reported that the deputation from this district, which met Sir Adam Beck on November 2 regarding further action in the matter of the Ontario West Shore Road, were advised by Sir Adam not to scrap the road at the present time but to look forward to using it later in connection with hydro radials to be constructed at various points of south-western Ontario. The whole matter hinged, according to the chairman of the Ontario Commission, on the action of the Ontario and Dominion governments in the matter of subsidies to hydro radials.

Granton, Ont.

A bý-law was carried by the town of Granton authorizing a contract with the hydro-electric commission for a supply of electric energy, the cost of sub-station and equipment to be $5,000.

Guelph, Ont.

The Bell Telephone Company refuses to longer supply free telephones for city use in Guelph, and it is understood the council is considering the necessity of installing a new fire alarm system. Bell telephones were utilized for fire alarm purposes under the old agreement.

Hamilton, Ont.

A conference of engineers and managers of the hydro-electric system throughout the province of Ontario was held in Hamilton on November 18 and 19. There was a very considerable attendance.

Halifax, N.S.

Members of the Halifax Power Company recently addressed the Commercial Club of Halifax, N. S., on the main features of their power proposition. A model of the watershed and power development was an interesting feature. It is stated that Mr. Mallison, of the Gaspereaux Power Company, will give a similar talk in the near future and explain the plans of that company.

Kingston, Ont.

The Power Committee of the Board of Trade of Kingston indicate their attitude towards the present electrical situation in that city by the following resolution which they recently adopted unanimously:—

> "Whereas the policy of the Utilities Commission has resulted in the loss to the city plant of many power consumers and has seriously injured the manufacturing interests of the city,
>
> "Be it resolved that this committee recommend that the Board of Trade urge the citizens to abolish the Commission and free the city from Hydro Electric influence."

The same committee also adopted a second resolution with regard to power supplied by the city to the local street railway company, as follows:—

> "Resolved that this Committee do recommend that the Board ask the Utilities Commission to make a definite offer of power at the present rate of 1 1-5c. per kw. hour to the Street Railway Company, so that the continued operation of the railway be assured.

London, Ont.

The Battle Creek Toasted Corn Flake Company are reported to be considering the use of electricity for toasting operations.

Montreal, Que.

The Gunn Electric Company, Limited, have secured a charter "to manufacture, repair, import, export, buy, sell, lease, rent and otherwise utilize and deal in, electrical hydraulic, mechanical and other machinery, appliances, apparatus and instruments of all kinds, and all tools, fittings, equipment and accessories, applicable or useful in that connection and to install, remove, alter and in any manner handle or deal with the same." The capital of the company is $20,000 and headquarters are to be at Montreal.

G. M. Gest, Limited, Montreal, have obtained a contract from the city of Montreal for removing the poles and other equipment on St. Catherine Street from Atwater to Papineau Avenues, rendered necessary by the installation of the conduit system.

Orangeville, Ont.

The Cataract Electric Company, Mr. J. M. Deagle, president, has just completed the installation of a 175 h.p.

water-wheel at their plant at Cataract. The company have also recently completed a new cement power house 20 ft. by 40 ft., one and a half storeys in height.

Otterville, Ont.

A by-law was passed by the ratepayers of Otterville authorizing the installation of a hydro-electric system to cost $2,150.

Peterborough, Ont.

The Dickson Electric Company have made a proposition to the city of Peterborough to supply them with electric energy up to 3,000 h.p. for $16 per h.p. delivered in Peterborough. The Peterborough commission is at present paying $18 per h.p. for about 2,500 h.p.

Quebec, P.Q.

The new electric supply house of Messrs. Goulet & Belanger, electrical engineers, fixtures and supplies, was formally opened on November 10. A public demonstration and entertainment marked the event, at which five thousand people are said to have been present. Souvenirs were presented, and refreshments, prepared entirely by electricity, served. Messrs. Goulet & Belanger have one of the handsomest stores in the city of Quebec.

Regina, Sask.

The firm of Bennett & Eadie, electrical contractors, Regina, has been dissolved.

Plans are under consideration by which the water pumps at Boggy Creek, the source of the city's water supply, may be driven by electric motor. At the present time gasoline engines are utilized. The pumps are situated some nine miles out of the city, but the city gaol lies in the course of the transmission line that would have to be erected, and at this point considerable power could be utilized.

Saskatoon, Sask.

The Western Electrical Company, Saskatoon, were burnt out recently; it is stated that the loss is fully covered by insurance.

The report of city electrical engineer Edward Hanson, of Saskatoon, for the month of October, shows that the power house output increased approximately 22 per cent. over the previous month, and is only 3 per cent. below the total for October, 1914. The monthly report of Mr. G. D. Archibald, the street railway superintendent, also indicates that the deficit in that utility is being gradually reduced and now stands at $1,886 for October, 1915. It is stated that the rural line to Sutherland is the most profitable of the entire system. These reports indicate the gradual improvement in local conditions which appears to be pretty general throughout Western Canada.

Salmon Arm, B.C.

Applications were received up to November 17 for the positions of chief engineer and assistant engineer at the city power house.

St. Catharines, Ont.

A recent judgment handed down by the Appellate Court reverses the previous decision of Chief Justice Falconbridge regarding the use of the poles of the Lincoln Electric Light and Power Company in St. Catharines by the local hydro commission. The company claim that their agreement with the city covered the use of these poles by the city for the city's own use, not including what it might sell to the citizens. The recent judgment, however, upholds the right of the municipality to use the poles of the company without any rental payment, for any purpose whatever.

A meeting of property owners of St. Paul Street between Ontario and Queen Streets was recently held and the question of a White Way type of lighting discussed. The contract with the Lincoln Electric Light Company expires in the near future.

St. John, P.Q.

The negotiations for the construction of a hydro-electric power development in the Lake St. John, P. Q., district, have made further progress, and some of the largest contractors in the Dominion were recently asked to figure on the work. The Quebec Development Company, Limited, is the controlling company. The proposal is to develop the Grand Discharge, at a cost of about five million dollars, with the object of manufacturing chemicals for fertilizers.

St. Hyacinthe, P.Q.

In connection with a new mechanical gravity filter plant for the city of St. Hyacinthe, P.Q., it is proposed to install two double suction type centrifugal pumps direct connected to two electric motors, provided with a starting device. The contractor will have to install the necessary switchboard, transformers, wiring, etc. Those bidding are asked to include the price of an extra two million gallon three stage electrically-driven pump for domestic use or in case of fire.

Southampton, Ont.

A proposition has been submitted to the town council by the Saugeen Electric Light Company suggesting improvements in the street lighting system. The company is anxious to operate the domestic and street lighting service on separate lines, not only that the town may be better lighted but also that the householders may make use of electric irons, toasters and other electric household necessities.

Sudbury, Ont.

The Fire, Water and Light Committee of Sudbury has been authorized to purchase a new transformer and switchboard for the power station as the result of a report by Engineer Martindale that the present equipment is overloaded.

Sherbrooke, P.Q.

Mr. M. A. Sammett, consulting engineer, Montreal, has been retained by the corporation of Sherbrooke, P. Q. The Corporation intends to carry out an extensive programme of improvements, covering modifications of water turbines, transmission lines, and city distribution.

Toronto, Ont.

The points at issue between the Toronto Hydro-Electric Commission and their striking employees have been settled. The employees accept the minority report as submitted by the third member of the arbitration board, which recently discussed the matter. Considering the fact that the conditions under which these men worked and the wages received were very favorable, there is no doubt they have taken the proper course.

Winnipeg, Man.

A severe sleet and wind storm on Sunday, November 7, succeeded in putting the Winnipeg Municipal electric plant out of commission for approximately twenty-four hours. The Winnipeg Electric apparently fared much better, and also were able to utilize their reserve steam and storage battery plants. The trouble with the municipal system was, we understand, entirely in the transmission line. It is said that this is the first failure in the city's system since the opening of the plant four years ago this month.

Zurich, Ont.

A by-law will be submitted at the New Year municipal elections asking authority to close a contract with the Hydro Electric Power Commission of Ontario for the supply of electrical energy.

Condensed Department

Publisher's Notice

Advertisements under "Situation Wanted" or "Situation Vacant" are charged at two cents a word per insertion, minimum charge 50 cents.

Advertisements for tenders, equipment, wanted or for sale, etc., or miscellaneous, are charged at $2.10 per inch.

All advertisements must be in the publisher's hands by the 10th or 23rd of the month to insure insertion in the subsequent issue.

BIDS WANTED

For building a ten-mile transmission line complete. For particulars apply to Box 265, Electrical News, Toronto. 23

SITUATIONS WANTED

Wanted by electrical contractor of 20 years' experience position as travelling representative or salesman. Apply Box 264, Electrical News, Toronto, Ont. 23-t.f.

AGENCIES WANTED

AGENCIES WANTED: Firms seeking to enter the Western Canadian territory, or any not satisfied with present representation, would find it to their advantage to communicate immediately with Houston & Company, Limited, 12 Cumberland Building, Winnipeg, Man. This firm have branch offices, and cover the three prairie provinces, and already represent such strong lines as, Delta Hand Lamps, Frantz Premier Electric Cleaners, Dongan Electric Specialties, and Canadian Beauty Heating Appliances (Sask. and Alta.) They invite correspondence. 23-24

Independent Telephone Convention

At the recent convention of Independent Telephone Companies of Ontario, held in Toronto, Mr. F. D. Mackay gave an interesting review of the Independent Telephone movement in Ontario. Mr. J. C. Kelsey, Chicago, spoke on "Maintenance and Depreciation of Telephone Plants." Mr. Myron A. Gee, of the Erie Telephone Company, addressed the Association on "Collections," and Mr. St. Clair Miller spoke on "Telephone Accounting." Mr. Andrew Denholm addressed the convention on the subject "Universal Service from the Independent Standpoint"; Mr. A. D. Bruce on "Is Free Interchange of Service Desirable?" and Mr. P. R. Craven on "Workmen's Compensation Act and Telephone Companies." In connection with the latter subject Mr. Wills Maclachlan, secretary of the Electrical Employers' Association of Ontario, also addressed the convention and cleared up a number of troublesome points.

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Generation, Transmission and Application of Electricity

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ADVERTISEMENTS
Orders for advertising should reach the office of publication not later than the 5th and 20th of the month. Changes in advertisements will be made whenever desired, without cost to the advertiser.

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The "Electrical News" will be mailed to subscribers in Canada and Great Britain, post free, for $2.00 per annum. United States and foreign, $2.50. Remit by currency, registered letter, or postal order payable to Hugh C. MacLean, Limited.
Subscribers are requested to promptly notify the publishers of failure or delay in delivery of paper.

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Vol. 24 Toronto, December 15, 1915 No. 24

Make Haste Slowly

Less than a month before election day the city of Toronto is asked to consider a by-law which calls for the expenditure of $4,200,000 in connection with a hydro radial scheme. Simultaneously the report of the investigating committee, composed of Messrs. Harris, Gaby and Cousins, appointed by the Toronto City Council, is made public, and calls for an expenditure of approximately nineteen million dollars. It is not at all clear that the two schemes can be worked in unison, as apparently they are not intended to be correlated in any way—one is a scheme of the Hydro-Electric Power Commission of Ontario, submitted by the chairman of that commission to the Toronto Board of Control. The other is a report asked for by the City Council.

It is quite possible these two reports may work in together satisfactorily. It is unbelievable, however, that two such reports prepared independently should dovetail together as well as if the engineers in charge of each project had been fully in touch with and influenced by the work of the others. It would appear, therefore, that the suggestion of Toronto voting on this four-million project is not feasible at the coming January elections. Even if there were no other proposition before them, a project which involves four million dollars requires more than one month's consideration—and that month, too, filled with many other municipal, and therefore political, issues.

* * *

Suppose, for example, that Toronto voted on this four-million-dollar by-law suggested by Sir Adam Beck, and that it passed—and that later it was found that this scheme did not work in well with the rapid transit report now before the Council. What could be done? Would it mean that the report would have to be thrown out, or revised to meet the plans of the Hydro Commission? It may possibly be argued by Sir Adam Beck that the proposition he offers is not as yet definitely determined, that he is simply asking the citizens of Toronto to entrust him with $4,200,000 to expend in the way he thinks best suited to the city's welfare. But this would not be a fair business proposition, and we do not believe the citizens of Toronto would care to vote under such conditions.

Then there is looming up large in the distance the question of the purchase of the Toronto Railway Company's system less than six years hence. It is impossible to form a guess as to what must be paid for that property, but the annual reports of this company indicate that they have assets of well over twenty million dollars, and presumably it is somewhere around this amount that Toronto will have to pay.

Summed up, then, the propositions either before the electors of Toronto at the present moment or requiring consideration in the very near future represent a total expenditure of forty-three million dollars on transportation facilities.

* * *

These three propositions seem to be so closely related that it would be extremely unwise to consider any one without at the same time discussing the others in relation to it. That being the case, the suggestion of a snap vote on the four-million-dollar expenditure at the coming New Year's election is unreasonable in the extreme. There is no immediate need to begin construction work on either of these propositions. The wiser course would plainly be to start the discussion now, or early in January, 1916, and continue it during the coming year, preparatory to voting on the entire proposition a year hence. In the meantime every attempt should be made to procure the widest possible discussion of the various phases of the whole work, especially from engineers, contractors and practical railway men, who are in a position, either through technical training or business experience, to express opinions which will be valuable to the man who has no means of forming an opinion for himself.

This is not written in any spirit of criticism of the by-law that it is suggested to submit. It is not an appeal to the City Council to delay, but to make haste slowly. The future of Toronto depends largely on the solution of the transportation problems. The Council owes it to the citizens that every business man should have a fair chance to study this problem from all sides before we are launched on an expenditure which works out at about $90 per head of the total population.

A fire alarm and police patrol system (the Gamewell) has been installed on St. Catherine and Bleury Streets, and a portion of Park Avenue, Montreal, in connection with the underground conduits. The boxes on the street corners also contain telephones. The private fire alarm boxes are connected to the main cables.

Surface Only Scratched

Canada was asked for fifty millions, and easily made it one hundred and ten. There is no evidence, either, that the financial resources of the Dominion have been more than merely "scratched." This may be a small "pill," but it will certainly have something of a bitter taste for our bankrupt enemies.

Wire and Wireless Telephony Advances

Recent developments indicate the possibilities of the future—Round-the-world conversation—An interesting description of experiments and apparatus

By Mr. J. M. F. Wilson, B.Sc. (London)

The remarkable results obtained a few weeks ago in transmitting speech nearly 5,000 miles have come with a suddenness totally unexpected even by experienced engineers.

We learn, however, that the American Telegraph and Telephone Co. has been working quietly for several years to achieve this result.

The actual apparatus used is at present a secret until the question of patent rights is settled, yet we can make a fair guess by following the developments of the past few years.

The actual distance covered by wireless was about 2,500 miles, half the total, the remainder being due to the advance in wire telephony.

Advances in Wire Telephony

The conditions leading to the success of land wires were the outcome of a mathematical paper written by Oliver Heaviside in 1885.

In long lines the electromagnetic waves, produced by electrical speech impulses, suffer from two effects, attenuation and distortion. Attenuation means a reduction of the amplitude or maximum value of the wave, caused by resistance in the line, mutual inductance, and leakage. Attenuation alone is not harmful to speech transmission. The speech is merely weakened. Distortion on the other hand is caused by waves of different periods being unequally affected. The capacity of the line is the main factor in causing this distortion. Not only does it decrease the velocity but it tends to entirely wipe out waves of high pitch. Capacity however may be neutralized in one or two ways. Artificial leaks may be added to the line but this is unsatisfactory compared with adding inductance. At first telephone cables were tried having iron wrappings along the entire length but it was not until 1900 that Prof. Pupin developed mathematically that inductance coils should be added at certain stated intervals to get the best effect. He gave at the same time a technical analogy to help the lay mind which admits of an easy explanation.

An elastic cord attached at one end to a prong of a tuning fork and fixed at the other would represent capacity in a line. If it vibrates with no friction it will produce a series of undamped waves as in Fig. 1 (b). With friction it would suffer attenuation as in (c). Now let little weights be attached at intervals as in (d). These would represent inductance coils or loading coils adding inertia to the circuit. The result of vibration is now to produce a long wave as in a heavy cord with no attenuation. This is shown in (e). Fig. 2 shows the method of inserting these loading coils into the Anglo-French submarine cable. The speech conditions were thereby improved by as much as 220 per cent.

Wire telephony has also been greatly benefited by very sensitive relays and repeaters which have recently been invented. The repeater used by the American Bell Telephone Company is practically the same in principle as one to be described later in connection with wireless receivers.

In Great Britain a recent very sensitive type is known as the Brown Relay. It is based on a discovery of J. J. Thomson that if a spark gap can be maintained in a space of from one-half to one-millionth of a centimetre, the spark potential is proportional to the distance.

In the relay, the gap is maintained between contacts of osmium iridium working under a drop of thin oil. These act in a similar way to the carbon granules of an ordinary transmitter. The upper contact is attached to the adjusting screw while the lower is fixed to a reed of "Inver" steel. The contacts form a circuit with the lower magnet coils, an ammeter for adjusting purposes, a cell, and a receiver. The coils keep the gap at a fixed distance in exactly the same manner that an arc lamp does. The current to be magnified is taken round the fine wire coils on the pole tips, and acts on the lower side of the steel reed, while its inductive effect on the regulating winding is annulled by a copper sheath. As one relay will magnify twenty times, two coupled in tandem will do so four hundred times. In spite of its sensitiveness it may be turned upside down while working.

Advances in Wireless Telephony

To thoroughly understand the advance made in wireless telephony, we must follow the work of the wireless telegraphist. The discovery that the discharge of a Leyden jar is oscillatory or consists of a series of discharges is now a matter of history. In wireless work the original circuit producing the "high frequency oscillations," consisting of an ordinary induction coil, a spark gap connected across the secondary terminals together with a Leyden jar or condenser, differs in one respect only from the simplest wireless circuit. The Leyden jar is replaced by an aerial and a ground connection, one to each terminal of the gap. It amounts to the same thing as making a condenser with a large distance between the plates. Such an arrangement increases the area over which the oscillations exert their influence. As the current surges up and down the aerial, electromagnetic waves are produced which in turn set up a strain in the surrounding ether, and cause the waves to travel out from the system, like ripples in a pool when a pebble is thrown in. These waves have the power of exciting corresponding oscillations in a conductor or aerial on which they impinge, but grow weaker the greater the distance travelled.

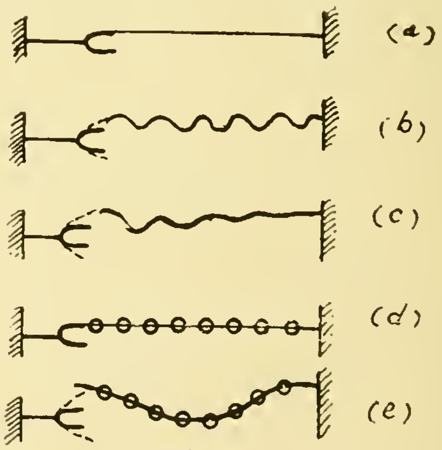


Fig. 1.

It would be of no use to include an ordinary receiver between the aerial and ground, as owing to the induction of the coils of the receiver, the small currents would not affect it. Consequently the receiver is shunted by some form of detector, crystal type, for example, where the high

frequency currents coming in from the aerial heat the fine point where it touches the crystal and forms a thermocouple producing a direct current which will now affect the receiver.

The range of such a simple type is very limited. To intensify the action one method is to make use of directive aerials. For example, if the vertical wire is attached to one end of à number of horizontal aerials it will radiate most in the direction opposite to the free end. Another means makes use of the principle of resonance. The correct tuning

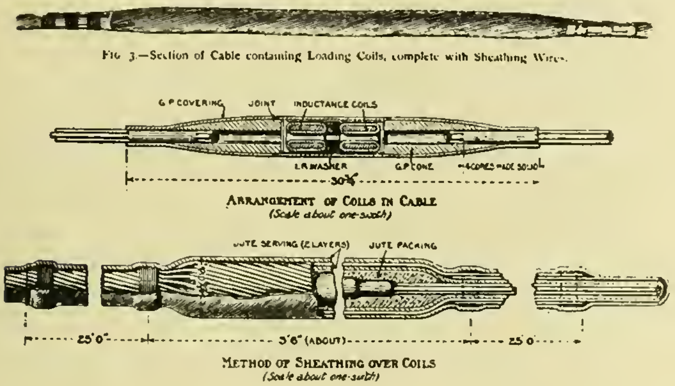


Fig. 2.

of the pushes on a swing increases the arc by the "superimposed small periodic motions" as Kelvin called it, or a note sung into a piano with the loud pedal down picks out a string in harmony with it due to the impulses of the voice acting at equal intervals producing a cumulative effect on the string. Now if we couple across the spark gap a coil of wire and a condenser, a certain definite number of oscillations are set up between the coil and the condenser which can be shown mathematically to be represented by the formula $N = \dfrac{5 \times 10^6}{\sqrt{LC}}$ where N = number of oscillations, L = inductance of the coil in ohms, C = capacity of the condenser in micro-farads.

The length of the wave which is inversely proportional to this number N may therefore be regulated to anything we like, but practical considerations and legal regulations confine the wave length to distances varying from 150 to 6,000 metres. For transatlantic work the larger wave length is used.

Again if we couple another coil L_2 with the first L_1 and attach our aerial and ground connections as shown (Fig. 3) we may adjust L_2 so that the natural vibrations of L_2 combined with the capacity of the aerial C_2 will have the same frequency of vibration as L_1 combined with C_1. This happens when $L_1 C_1 = L_2 C_2$. Resonance is then produced. At the same time we may observe that since C_2 is small, L_2 will be very large compared with L_1 and this will be beneficial as it will increase the voltage which radiates the energy from the aerial. By adding loading coils and variable condensers to the aerial, the circuit may be adjusted to get the best effect.

The receiving system is tuned in exactly the same way but as the system of circuits in telephony is similar to that in telegraphy we shall have occasion to return to this later. When an induction coil or transformer is used as above to produce the oscillations there are long pauses when no surges occur in the aerial. In addition each set of waves is damped or alternated. If therefore we included a telephone transmitter in the aerial circuit since the voice produces oscillations which are quite continuous, only parts of the sounds would be transmitted. The quality and recognition of the voice depending as it does on its upper harmonics would be completely destroyed.

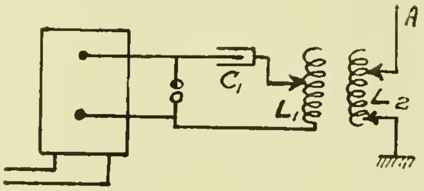
We have then to find a means of producing undamped oscillations before the voice can be transmitted. Not only that, we must have their periodicity (N) higher than those of the highest harmonics of the voice otherwise a continuous hum will be heard in the receivers. The higher limit of audibility is about 30,000 vibrations a second. The impressions of the voice must then be powerful enough to modify the stream of electrical waves in accordance with the sound waves.

Alternating current generators have been constructed for this purpose, notably those of Goldschwidt and Fessenden. In the Goldschwidt the armature rotates about 10,000 r.p.m., being turbo-driven. The primary frequency is stepped up by carrying it back through the field so as to produce a rotating field. The frequency of the current from this source is again stepped up to the required frequency. Condensers are used to balance the circuits electrically.

There are tremendous difficulties to overcome in the construction of such alternations. The above machine for example has stampings of iron foil .002 in. thick. It may however transpire that such a type of alternator was used in the test between Hawaii and Washington.

Up to the present however most experimenters have worked on a method based on a discovery generally credited to Duddell, viz., the musical arc. A source of direct current about 220 volts pressure is impressed on an arc through a resistance R. Fig. 4. Two inductive coils are included to prevent the oscillations of the arc from going back on the main circuit. Across the arc an oscillating circuit is fixed. The induction coil and the condenser out of an ordinary long distance telephone set may be used for this purpose.

Owing to the property of an arc that the voltage is in inverse proportion to the current through the arc, the sudden connection of a condenser across the arc slightly reduces the current through the arc. Its voltage therefore rises and forces a further charge into the condenser. When the charge is completed the current in the arc rises to its old



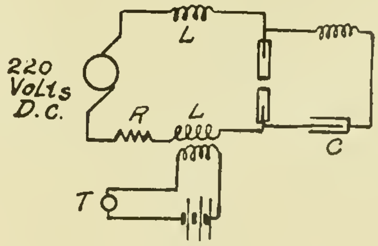


Fig. 3 (above). Fig. 4 (below).

value, hence its potential difference drops and the condenser begins to discharge. Hence an increase in current which facilitates the discharge. By including a coil L the circuit has a natural frequency of its own, producing undamped oscillations. If this is low, the arc will emit a note which may be altered by varying the capacity of the condenser. By altering the current through the arc by means of a transmitter connected as shown (Fig. 4, T.) it may be made to repeat a tune.

In order to produce the higher frequency oscillations

necessary for telephony experiments, L and C must be reduced to suitable dimensions. For example 5 milli-henrys and 5 micro-farads for a musical arc would have to be changed to 0.1 milli-henrys and 0.004 micro-farads. The consequence is that much more powerful impulses both from the transmitter and the arc are necessary to produce any effect.

Poulsen of Copenhagen, was the first to discover, (1) the use of a hydrocarbon gas or hydrogen for cooling the arc, (2) the effect of cooling one electrode, and (3) the effect of blowing out the arc by means of a transverse magnetic field.

The greatly increased power depends on the fact that the arc is working on a part of its characteristic where large variations of voltage occur for a small change in current.

Instead of using a strong field and a gas surrounding the arc, it has also been found that good results are obtained from merely using several arcs in series. The transmitter may be inserted in the condenser shunt circuit or in an

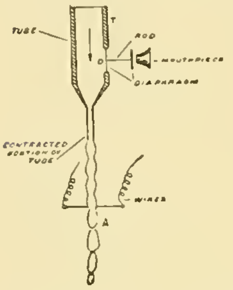


Fig. 5.

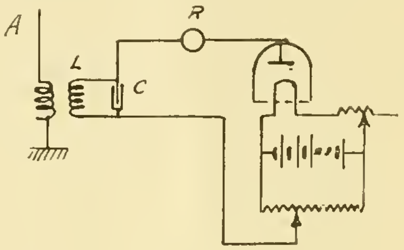


Fig. 6.

inductive circuit coupled with the coil. As however a single microphone can only carry from one half to one ampere without overheating, it must be inserted at a central point or at a node of potential to avoid arcing.

A number of transmitters may be used in parallel or in series or the transmitter may be artificially cooled. Prof. Majorana of Rome has carried out very successful experiments on one of the latter type using large currents. It depends on the principle that a jet of water under pressure divides into drops. If therefore acidulated water is made to impinge on two platinum pieces to complete a circuit, the film of liquid may be varied in thickness if the jet is spoken against, hence its resistence is altered to correspond with the vibrations of the voice. This circuit is part of the aerial circuit (Fig. 5).

In regard to the receiving circuit the detector must be capable of altering its resistance in proportion to the received impulses. Thermo-electric, crystal, electrotype detectors may be used but by far the most sensitive is the glow lamp type originally discovered by Fleming.

Fleming discovered that, if a metal cylinder surround the filament of a carbon lamp, when the filament is rendered incandescent, a single cell will pass current from the cylinder to the filament, provided the positive terminal of the cell is attached to the cylinder (Fig. 6). Negative electrons are thrown off from the hot filament and complete the circuit of the cell. Because of its unilateral conductivity Fleming calls it an oscillation valve. When a certain voltage, about 20, is impressed on the electrodes very large changes in current through the vacuum are obtained for a very small change in voltage. Fleming found that a tungsten filament and a copper cylinder gave the best results.

De Forest states that the audion is twenty times more sensitive than any other type, liquid or crystal, and it is no doubt due to its development that we have to record the remarkable results just obtained.

De Forest has also found that an audion can be used as a generator of undamped waves. If it can be used on a powerful scale as predicted, its simplicity will open out a field of usefulness which is almost beyond our imagination to conceive.

Engineering Features of Cedars Plant

Mr. Julian C. Smith's paper before the Canadian Society of Civil Engineers, treating of the general hydraulic design, hydraulic machinery, auxiliary equipment, and some phases of the construction work of the Cedars Rapids Manufacturing and Power Company's plant, contains a quantity of interesting information not before made public. For example, in the precautions taken to avoid ice trouble wonderful ingenuity has been shown, and advantage has apparently been taken of every natural condition. The general direction of the water as it enters the forebay has been arranged as nearly as possible so that it is at right angles to the main flow of the River St. Lawrence. In addition to this a series of cribs has been constructed from the bank of the river and extending downstream more or less at right angles to the current, with the idea of deflecting the main current of the river further out into the river and thereby reducing the probability of floating material entering the canal. It was argued that if ice of various sorts could be driven out into the swift water of the main part of the stream the amount taken into the canal would be very much reduced.

As additional precaution against ice troubles two sets of openings through the canal bank are provided—one near the upper end of the canal, consisting of seventeen openings each having a free span of 15 feet. These openings are normally closed with stoplogs with the crest of the concrete still about 10 feet below the lowest water. A similar set of openings, but not quite so long, is provided immedately above the power house. The idea in connection with these openings is that by adjusting the stoplogs, so as to provide an overflow of about two feet, a high surface velocity can be obtained, particularly in the neighborhood of the spillway itself, and that ice guided in this direction by properly located booms will flow out of the canal through these openings.

Through the power house itself, which will ultimately be 1,200 feet long, a number of openings are being provided—three openings in the present structure, which is 700 feet long. These openings are to serve the purpose of removing ice or other material which may collect before the power house, without the necessity of passing this material clear across the full length of the building.

Thrust Bearings

The paper describes in a very interesting manner the design of thrust bearing finally adopted, and the reasons therefor. The following quotations are taken direct from Mr. Smith's paper:—

"In the sub-structure as constructed provision was made for ten units, each of about 10,800 h.p., and three exciters or auxiliary units, each of 1,500 h.p.

"Before the design could be developed completely,

the type of thrust bearing to be used in case the vertical unit was chosen had to be decided upon.

"There are several types of thrust bearings now in common use in power developments, amongst them being the oil pressure bearing, the roller bearing, and the Kingsbury bearing.

"The oil pressure bearing is familiar to you all, consisting as it does of an oil film maintained by pumps between a stationary plate and a rotating plate.

"The roller bearing has been developed and is in common use on small units. A few installations have been made on large units, and at the time this plant was designed, some three years ago, a careful study was made of the roller bearing.

"The roller bearing had a number of very good points, inasmuch as it was a positive support to the rotating parts, and the lubricating system only needed to be sufficient to circulate and cool the oil. Some difficulties had been experienced in a few plants with roller bearings, particularly on account of the difficulties in obtaining suitable steel plates to serve as a bearing surface against which the rollers operate. It seemed to be an extremely difficult thing to obtain a piece of steel of uniform hardness, and which would not deflect or warp when the temperature rose.

The Kingsbury Bearing

"The third type of bearing, and the one finally chosen, is a new design, and one which has rapidly come into prominence in the last few years. This bearing was invented and manufactured by Albert Kingsbury, of Pittsburgh, and while having some of the advantages of the roller bearing, possesses advantages of its own.

"It has certain disadvantages also, but these disadvantages seemed to have been met at the time we ordered the bearings, and the performance of the bearings has borne out the wisdom of deciding to adopt that style of apparatus.

"The Kingsbury bearing depends, like the oil thrust bearing, on the oil film maintained between a rotating plate and a fixed surface. The fixed surface, however, is not a continuous plate, but is made up of a number of sectors, each independently supported and each free to rock slightly. By this device the oil is entrained between the fixed plate and the rotating plate on account of the viscosity of the oil, and an oil film established as soon as the machine has made a part of a revolution.

"After the machine gets to full speed, the rotating part rises about one or two thousandths of an inch on the oil film, and after that the friction is reduced to a very low amount, the losses in this bearing being considerably less than in the roller bearings.

"The weak part in connection with the Kingsbury bearing is at the time when the machines come to rest. At that time the oil film is squeezed out and the machine starts practically metal to metal.

"By the use of a very hard babbit, containing a high percentage of tin and a carefully machined and scraped surface, no injurious results take place, and with due precautions in starting and stopping these machines the results obtained have been very satisfactory.

"Having decided on the use of a thrust bearing of the type mentioned above, it was then decided to place the thrust bearing on the top of the machine in order to make the bearing accessible, and to reduce the thickness of concrete required under the machine.

"If a thrust bearing of any type had been put between the water-wheel and the generator, it would have been necessary to have provided a tunnel passage for these bearings to make them accessible, and therefore the floor level of the power house would necessarily have been changed.

"In order to carry the thrust bearing on the generator, cast-iron brackets were designed by the water-wheel company, and calculations made not only as regards their strength but particularly as regards the deflection.

"The rigidity of this construction was one of the main reasons why this design was finally adopted, as it was deemed necessary to provide a design which would give as little vibration as possible.

"This can readily be understood when the dimensions of the oil film, that is about one to two thousandths of an inch, are mentioned."

Another section of Mr. Smith's paper gives the following construction data,—

"Work with one steam shovel was commenced towards the end of 1912. The crib work was finished, pumps were installed, and most of the work of unwatering and the arrangement of the construction plant was designed and largely completed in 1912, and the spring of 1913. In the spring of 1913 a contract was entered into with Fraser, Bruce & Company by which these contractors undertook the excavation, concrete work in the power house, and in general the main features of the work except the superstructure of the power house, and transformer house, and the installation of the apparatus in the power house. During 1913 a considerable amount of the south bank was completed, and work commenced on that part of the south bank extending across the rapids to the Isle aux Vaches.

"During the fall of 1913, and in 1914, eight steam shovels were at work, twenty-eight locomotives, and two hundred 6-yard and thirty-six 12-yard cars. The performance of the steam shovels varied tremendously, as would be expected in different classes of material. When excavating clay at the lower end of the canal near the power house the No. 1 shovel made the best record, taking out about 47,000 cubic yards place measurement of material in the day shift, and about 21,000 cubic yards in the night shift, in a month. When excavating boulders which formed the original bed of the river, these boulders being more or less cemented into place, but not requiring drilling, one shovel took out about 20,000 yards in one month.

"When excavating rock which required to be drilled and blasted, the shovel performance was about 11,000 cubic yards per month per shovel.

"It can be readily understood from the description which has been made, that the construction plant for handling this work was in itself very extensive. The engineering features involved in the design and the operation of this plant were quite a job in themselves. Outside of the steam shovel and transportation plant above mentioned, two air compressor plants were installed, each plant having an aggregate capacity of 2,500 cubic feet of free air per minute when in operation.

"A machine shop, carpenter shop, and blacksmith's shop and various other small shops were required for

the operation of this construction plant. Electric power was used from the nearby station of the Montreal Light, Heat & Power Company, the maximum used being in 1914, about 2,500 h.p.

"The construction plant, including what belonged to the Cedars company, and to the contractors, cost in excess of $600,000. This figure is mentioned as showing the very extensive amount of plant required for a job of this nature. Extensive temporary buildings were also required, approximately $85,000 being expended for this work.

"The first concrete was in place in the power house in August, 1913, and the power house concrete was completed in October, 1914; the total amount of concrete in the power house being 79,000 yards, plus 1,500 yards of grout. This concrete was put in at the rate of 600 cubic yards per day under best conditions."

Electro-Thermal Smelting of Iron Ore

The Department of Mines of Canada have just issued a report on the electro-thermic smelting of iron ores in Sweden, prepared by Alfred Stanfield, D.Sc. Dr. Stanfield visited Sweden during June and July of 1914 for the purpose of inspecting the principal smelting plants, and met many engineers and other men well informed in regard to electric iron smelting.

Dr. Stanfield's report states that there are two main types of electric furnaces for smelting iron ores:—

(1) The Elektrometall furnace, in which the ore is preheated and partially reduced in a shaft before it reaches the smelting chamber; the heating of the ore in the shaft and the chemical reduction of the iron in the ore are materially assisted by the circulation of the furnace gas.

(2) Furnaces of the Helfenstein, Californian and Tinfos type, in which there is no provision for preheating the ore. Any shafts employed are merely for the purpose of introducing the ore charge conveniently, and the main object of the design is to obtain a large and substantial furnace for smelting iron ores electrically.

In Sweden the first type of furnace has been largely used, and is in regular commercial operation, but experiments are now being made with a modified Helfenstein furnace. In Norway the Tinfos furnace is in operation on a moderate scale.

The Elektrometall Furnace

The report does not contain a minute description of this furnace, which has been described by various writers. The crucible is circular and provided with one tapping hole from which both the slag and the metal are withdrawn. The metal and slag are separated by a dam as they flow, the metal being cast into pigs or taken in a ladle to the Bessemer converter or the open-hearth furnace. The crucible is lined with fire-brick, and not, as in the earlier furnaces, with magnesite. The stack of the furnace is constructed in a steel shell and is supported on steel beams independent of the crucible.

The electrodes are circular, about two feet in diameter, and four or five feet long. The electrode holders consist of two inclined guides between which the electrodes lie supported by guide rollers. At the bottom of these guides is a water-cooled collar, supported from above and packed around the electrodes with asbestos supplied with three-phase current from three transformers. The electrodes do not as a rule need attention oftener than once in two or three days. The circulation of the furnace gas is an important feature in this type of furnace. The gas is withdrawn from the top of the furnace, passed through dust-catchers, and then through pipes, where it meets a water-spray. It is then passed through a centrifugal fan, also supplied with a water-spray, and finally through a drying chamber for the removal of the entangled water.

The Helfenstein Type

The best-known example is the furnace built by the Noble Electric Steel Company at Heroult, California, U.S.A. This type of furnace consists of a large smelting chamber, usually rectangular, having a number of vertical electrodes which enter through the roof. The ore is introduced through a number of chutes, but, as already noted, no attempt is made to preheat the ore before it enters the smelting chamber. The economy obtained by the large shaft and efficient gas circulation of the Elektrometall type of furnace is deliberately abandoned in the Helfenstein type, attention being centred rather on the provision of a large and substantial smelting chamber in which the smelting can be carried out rapidly by electric energy. The economy of this type of furnace increases with the amount of power employed. It is estimated that by building a furnace to use 12,000 h.p. instead of 4,000 h.p., an increase in economy may be obtained which will offset the loss due to the absence of a preheating stack.

Electric Iron Smelting in Sweden

Under this heading the report states that the electric iron smelting industry is well established in Sweden, that five furnaces are in regular commercial use, and that at least three more are in course of erection. The Swedish iron industry consists, in the main, of smelting pure Swedish ores with charcoal in blast furnaces of very moderate dimensions and small yield. For this reason blast furnaces have been replaceable by electric furnaces, which in Sweden are commercially satisfactory. It is noted, however, that this is on account of the small size of the furnace used in Sweden, and on account of the high-grade quality of iron obtainable readily from the Swedish ore.

Electric Iron Smelting in Canada

The report goes on to discuss the possibilities of smelting iron by electricity in Canada. It is pointed out that the scale on which ore is turned out from the blast furnaces is here very much greater than in Sweden. The furnaces are larger, and the quality of iron is not so fine. These things considered, as well as certain other factors which add to the high cost of production, Dr. Stanfield is of the opinion that "at the present there is no evidence to show that electric iron smelting can be undertaken on a large scale in competition with the existing blast furnace industry." If, however, a purer quality of iron is required, the electric furnace appears to be the best, and almost only, method of producing it. The difficulty is with the sulphur contained in the iron ore.

In the Public Eye

A Budget of Comment on Men and Things of Moment Served Without Party Sauce

A correspondent writes to ask what Sir Geo. E. Foster and his department of Trade and Commerce have been doing to improve the opportunities offered for the expansion of Canadian commerce by the war and the banishment of Germany from the markets of the world—Canada at least. And the answer comes without a moment's hesitation. Sir George has been making speeches. You must have noticed that if you read the daily papers. Anyway, did you ever know him to be doing anything else? That is Sir George's forte. He talks and talks, and it doesn't matter a continental whether or not he knows what he's talking about.

* * *

Now, as Minister of Trade and Commerce, what would you expect Sir George to do when millions of munitions contracts were floating around the continent to which he occasionally belongs? Wouldn't you think he would inventory his factories, obtain concise information regarding their fitness and capacity for producing war supplies, and, in short, do everything in his power to bring together the buyers of supplies and the men who could manufacture them? Well, you're right; that's exactly what he did not do. Instead, he went about addressing recruiting meetings. Lloyd George had said this is a war of munitions rather than men. So Sir George figured: "Munitions, why they might have to do with my department. So I'll go out after recruits." Of course, he's such a nice warm-hearted genial chap that men rushed to arms in millions as soon as he asked them to. But that's neither here nor there. The point is that Sir George "seen his duty and done it."

* * *

But meanwhile his department is doing a great work in getting out blue books and a weekly trade report that is almost as useful to manufacturers as the financial pages of newspapers are to business men. By the time the information contained in them reaches the public, the opportunity is gone. In fact so valuable are these books that a live manufacturer rarely wastes his time reading them. However, they have their uses. The financial pages pounce on them and joyously announce to the country that the trade of the Dominion has reached a billion. And the manufacturer says, a trifle sadly: "That's nice, but how is it going to help me to get a South American market?"

* * *

Some day somebody is going to arise in parliament and ask: (1) How many trade opportunities have been developed for Canadian manufacturers by the Department of Trade and Commerce? (2) To what extent has trade in Canada been developed in the last ten years; how much of this development is normal and how much can be traced directly to the department?

And then Sir George E. Foster will make another speech.

* * *

Wasn't it one righteous man that was required to save Sodom and Gomorrah? Doesn't it look to you as if one straight, honest, non-partisan man was required to save the government? Britain has Lloyd George, who has made munitions a business rather than a political perquisite. In the United States Pierpont Morgan has inventoried the factories and their capacities, and the man who can deliver the goods at the right price can get a contract. Is it not possible to place war contracts in Canada on the same basis? In this time of stress, when the Empire needs the united effort of all its people, I hate to be classed with the kickers. But wherever you turn it is the same cry of politics, pull and graft. There are the shell contracts, going to the favored few, the shell-box contracts, going to builders of dams, the contracts for uniforms going to the real estate men, the aged and decrepit horses bought in the east, the horses with abnormal appetites for hay in the west, strange tales of the Ross rifle and a faint echo from the submarines on the Pacific coast. The official investigator, Judge Davidson, a Borden government appointment, can't find time to make a report on one before he is hurried off to look into something else.

* * *

Compound "profiteering" is the latest phase of money making at the expense of the Empire. The corporation that secures a contract that shows a hundred thousand dollars profit figures that it means dividends on another million dollars of stock. The stock is issued, unloaded on the confiding public and the $100,000 is turned into a million. With the proper connections and an elastic conscience much may be accomplished in those circles which figure that it is better to be a live millionaire than a dead hero.

* * *

Economy as a road to wealth has been preached to us from our youth upwards but it remained for Prof. Wrong of Toronto University to advise us to use the same material in building a road to victory. The learned professor advises us to buy only the necessaries of life, wear our old clothes and make the wife's spring bonnet do a reappearance for the fall. This is what a lot of our people did in the panic that followed the declaration of war. Rich men discharged their chauffeurs and drove their own cars. Wealthy women cut down their domestic help and forgot to patronize the milliner and dressmaker. If the rich didn't get richer the poor certainly got poorer and business was at a standstill. Fortunately we recovered before the whole country stagnated. The "business as usual" motto was printed on the wall and stamped on the door mat. As a result the Government has floated a war loan of $50,000,000 that was subscribed in a single day and business in nearly every line threatens to boom. Economy properly applied is a grand thing. It might not be a bad idea to economize by cutting the salaries of theorizing college professors, who talk learned nonsense.

* * *

Subscription lists to right of us, tag days to left of us—wherever we go. We are reminded that the present war is being carried on as a charitable institution rather than a National undertaking. Why should it be left to the charitably inclined to support the families of soldiers fighting the country's battles? Why should it be necessary to pass the hat for funds to aid recruiting? Why should it be left to the generous to provide funds to be used in the interests of all? The government should accept its responsibilities rather than try to pass them on to the shoulders of others. The government has just as much right to provide the necessary money to secure recruits as it has to equip those recruits and pay them after they are equipped. The care of the families of those recruits is just as much a government responsibility as the payment of any other debt. He who cannot fight must pay his share. But on the Government should rest the responsibility of seeing that every man should pay in proportion to his ability and the stake he has in the country. This can only be done by the Govern-

ment paying all bills and assessing the cost fairly on all concerned. The present haphazard system of doing things condemns the public-spirited citizen to pay not only his own share but also the share of the mean-spirited money-grabber who hoards every dollar till it is extracted by main force. There are wealthy men right around us who so far have not contributed a dollar for patriotic purposes. They never will contribute till the Government takes hold and tacks their share on to their tax bills.

* * *

The new Munitions Board has been announced by Mr. Hichens. It is eminently respectable from the chairman, Mr. J. W. Flavelle, to the member from far off Victoria. It is directly responsible to Lloyd George and as independent of the Canadian Government and Canadian politics as its members see fit to make it. Sir Sam Hughes has been placated for the practical obliteration of his Shell Committee by being made honorary chairman of the new body. It would be nice to know just what his powers and duties are. The two other military members of the Shell Committee, Brigadier General Bertram and Colonel Carnegie, have also been retained, the former as vice-chairman. The manufacturing members have been appointed to a committee on raw materials. Even they do not get a raw deal though their new positions are as "honorary" as their recently acquired colonelcies.

* * *

So we have the new Board and all we can do is to sit back and wait to see how it will act. In the meantime Sir Robert Borden must have heaved a great sigh of relief when Mr. Hichens pronounced those few kind words that served as the obituary of the Shell Committee. For each day brings forth fresh evidences of the peculiar brand of patriotism that characterized its every action. We now hear of a publisher who has been awarded a shell contract. That he did not have a plant when the contract was secured apparently mattered not. Neither was it of any consequence that he knew not the first rudiments of making shells. He has evidently since secured at least a site for his shell factory as last week he was in the United States buying machinery.

* * *

Fifteen British journals have refused to accept Ford advertisements. They consider the Detroit car an alien enemy and refuse to do business with him. But up to the time of going to press not one Canadian paper has developed any symptoms of following suit. It is a notorious fact that our Canadian newspapers, with few exceptions, fail to recognize that they are under any obligation to their readers. They evidently figure that they give him a cent's worth of news for his copper. Beyond that "the public be ————." The feelings of the advertisers are considered generally, and the party to which they are proud to belong, always. In other words their advertising columns are at the service of mining stock speculators, oil company promoters and any other "bunk" operators who have money to spend. Similarly their editorial columns are filled with party eulogies and counter-charges against the opposing party that are calculated to deceive the public even as the fraudulent advertisers calculate to rob it. Is it any wonder that the public is taking the press even as its proprietors make it? A newspaper was once a public institution. It was a friend that called at the home each morning or evening to discuss the events of the day and offer friendly advice concerning them. That time is past. A newspaper is now a private business venture. It has but one object and that is to make money —or to serve some one party or individual. Of course, part of its money making equipment is a certain influence with the public.

* * *

The United States is not only gathering in all the munition orders in sight but is reaching out after the markets left open by Germany's exclusion from them. France too has decided that it will not always be war time and that after the Germans have been driven back across the Rhine the rebuilding of her industries will be the next great task. Even now she has a "machinery committee," in the United States composed of representatives of French agriculture, banking, commerce and industry. Each member is an expert in his line. They are observing, planning and inspecting. The buying will come after the war and it is estimated that their initial orders for machinery will amount to a billion dollars. Maurice Damour, Secretary of the Appropriations Committee of the Chamber of Deputies, who heads the committee, explains its objects as follows:

"We want to effect a general modernization in all French commercial, industrial, and agricultural lines. With our population reduced by war we will be compelled to equip our factories with modern machinery. The money that we spent in Germany for that purpose will be spent in the United States. The figure of $160,000,000 a year is small compared to what will be spent in the future, because the machinery of northern France has been destroyed, and as the Germans withdraw they will leave little that can be used by us. We shall eventually buy every kind of machinery, agricultural implements, tools, hardware, spinning machinery, and mining machinery. In return we want the United States to buy the manufactured output that the United States formerly bought from Germany, our toys, for instance."

"This is ample evidence that America's work in the near future is to rebuild Europe. By America I do not mean the United States but the North American continent, of which we, so humbly, form a part. What share is Canada going to take in the rebuilding? What steps are being taken to ensure her a reasonable part of the enormous business that is bound to come from that rebuilding? Is the French Machinery Committee going to visit us or is it to be allowed to sail for home under the impression that the Dominion produces good soldiers but mighty little else? Is our Minister of Trade and Commerce up and doing or simply up and orating? Is his department still busy producing blue books and trade reports or is it alive to the fact that trade for the future is of vastly more importance than reports of the past? Our business at present may be war. But if France, with the Huns within hailing distance of Paris, can still work out the future of her commerce surely Canada can spare Sir George Foster from the recruiting platform for long enough to get in touch with the French Committee and see if it cannot purchase some of its machinery from the people who are helping to drive the invader out of its country.

* * *

The resignation of the reverend editor of The Globe recalls the high hopes entertained by lovers of clean politics when, many years ago, it was announced that Dr. J. A. Macdonald would henceforth direct the destinies of one of Canada's most prominent dailies. With the prestige of the "cloth," backed by one of the most powerful religious organizations in the world, it was surely not too much to expect that Mr. Macdonald would now make himself heard in favor of clean government and in defence of his readers—the public. The "barnacles" continue to "stick," however, in comfort, and the public continue to be duped with the fox-farm and oil-stock advertisements—just like the other big dailies print. It was a splendid harvest that lay spread before him, and an efficient organization of harvesters was at his disposal. That he neglected to reap even a small portion will ever remain a keen disappointment to all honest electors.

"SEARCHLIGHT"

Electric Railways

Concrete pavement in the track allowance—Many railways using it with success—Description of best installation methods

by H. C. Campbell *

The widespread favor with which concrete is being received in the construction of street and highway pavements has aroused interest in its suitability for paving between car tracks. Permanence, ease of construction, moderate first cost and low maintenance charges are the distinctive merits claimed for concrete as a paving material. In Sioux City, Iowa, concrete paving between street car tracks has been used for a number of years and has given satisfactory and successful service. Some track in the city mentioned has ten-year-old concrete pavement which at the present time is in good condition. Concrete paving has been put in by the Sheboygan (Wis.) Railway & Electric Company, at Sheboygan and Plymouth, Wis., and the Mason City & Clear Lake Railway, Mason City, Iowa, has also had excellent success with concrete paving between its tracks in Mason City and Clear Lake. About three years ago six blocks were paved with concrete between the car tracks in Bay City, Mich., and the city engineer recently remarked that this was the best piece of pavement in the city. In addition to the cities already mentioned, Birmingham, Ala.; Denver, Col.; Port Huron, Mich.; Knoxville, Tenn.; Richmond, Ind.; Cleveland, Ohio; Minneapolis and Duluth, Minn.; Sioux Falls, S. D.; Manhattan, Kan., and Fond du Lac, Green Bay and Superior, Wis., have installed concrete paving in the track allowance.

Owing to the monolithic character of the concrete pavement, careful attention must be given to track design so that the necessity for frequently tearing up tracks will be eliminated. Efficiency of concrete paving between car tracks, therefore, depends greatly upon developing and using a type of track construction that will insure that the rails and other track fittings will endure as long as the pavement itself. Steel as well as wood ties, entirely embedded in concrete, have been used, and time has proved that both properly embedded in well-made concrete are protected from decay and corrosion, hence will certainly last as long as the pavement. Repairs to street railway tracks consist largely of rail joint maintenance. Unless a welded or riveted joint is used, no present-day type of rail connection escapes the necessity for occasional maintenance.

In most cities where concrete has been used for paving between the tracks the material has been placed in practically the same manner as when paving the remainder of the street. Only granite and trap rock should receive consideration as coarse aggregate for concrete pavements in the track space. As vehicular traffic largely follows the tracks, especially in winter when the railways have swept away the snow, shock and abrasion are more extensive on this portion of the paved area than on the remainder of the street. If either granite or trap rock is used the pavement surface exposed to wear offers resistance to abrasion equal, in a properly proportioned and graded mixture, to that afforded by granite block pavement. When the film of mortar that is flushed to the surface by floating the concrete has worn off as a result of traffic abrasion, a properly constructed pavement will present the appearance of a mosaic in which the units consist of granite chips varying in size from ¼ in. to 1½ in.

As the street section occupied by car tracks often receives more than its share of heavy vehicle traffic, wear along the rails is excessive. Heretofore the practice has been to lay stone block beside the rail, but where the amount of traffic is not great concrete can be laid directly against the rail. Two methods of construction have been followed when concrete is used. In some cases a construction joint is placed parallel to the rail and directly over the ends of the ties, and in other cases the concrete is laid from the rail to the curb in an unbroken stretch. When a joint along the track strip is contemplated the form is set and the concrete deposited for the street pavement between this form and the curb. After this strip is hard the form is removed and the space between it and the outside of the rail is concreted, leaving nothing between the two stretches of concrete except the construction joint at the ends of the ties. Whether a joint running at right angles with the ends of the ties is used or not, is very much a matter of personal choice. If used, there is no necessity for cutting the street pavement proper when renewing rails or repairing tracks. If

*In Electric Railway Journal

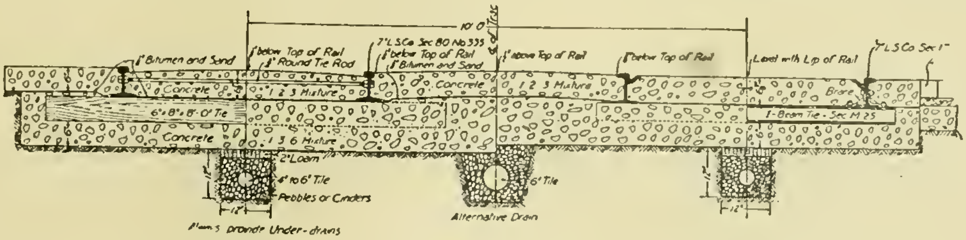


Fig.1—Alternative designs for concrete pavement between street railway tracks.

the street pavement proper is laid directly against the rails, the track must be very carefully constructed, otherwise if there is settlement or movement, the pavement usually cracks. Rail wear on curves is more rapid than on straight track, hence rail renewals are more frequent, and it is generally considered advisable to place a construction joint at the ends of ties on curves even though such practice is not followed on tangents.

When concrete is used for the entire pavement between rails, provision must be made for car-wheel flange clearance where the ordinary type of T-rail is used. In such cases the concrete flangeway is generally made 1 in. to 1¼ in. below the rail top. Investigation has disclosed that there is a strong tendency in present-day practice to form a deep groove for wheel-flange clearance. When the usual horse-drawn vehicle follows the line of rails, a detrimental prying action is exerted particularly when the wheels turn out of this groove, often resulting in chipping the pavement. To overcome this action a gradual crown can be obtained by using a strikeboard or template which is rested on the rails when striking off the concrete. Such a crown also provides drainage for the space between rails.

Generally speaking, the crown in the devil strip between tracks should start at the rail ¼ in. below the top and continue as a circular curve to the centre line of the strip. The ¼-in. clearance at the rail will allow for false flanges which otherwise cause the formation of a chamfer varying from ½ to 2 in. wide by ½ in. deep when the concrete is finished off flush with the rail top. As the car wheel tread is always equal to and usually greater than the width of rail head, any false flange wear will extend beyond the outside of the rail. Often wear in the wheels forms a slight flange on the tread, thus causing the outer portion of the tread to come in contact with the pavement surface unless the ¼-in. clearance is provided.

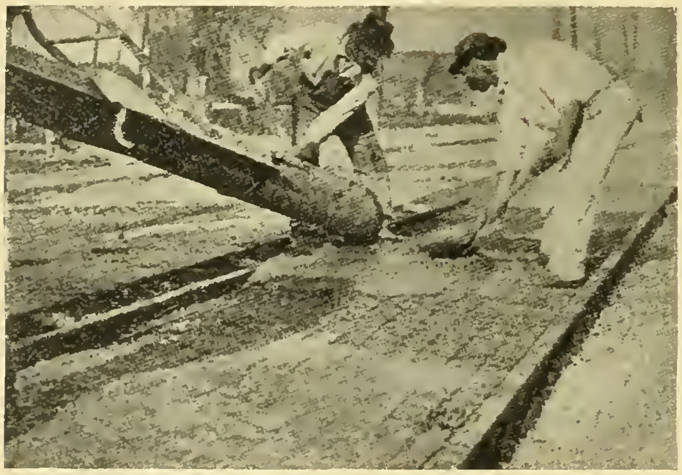


Fig. 2.—Spouting wearing course over mesh reinforcement laid on lower course.

When concrete pavement is used in the track allowance rail braces instead of tie rods seem preferable, as the tie rods tend to decrease the net section of concrete. If tie rods are used, however, those having a circular cross-section are preferable to the rectangular type now common in track construction where block pavement is used.

Owing to the severe shock due to the diversion of traffic near switch and frog points, extreme care should be exercised in the concrete construction at these points. Perfect bond between rails and pavement can be secured if the pavement is properly and sufficiently protected while hardening. For this reason special care should be taken to practise the best curing methods and close the paved portion to traffic while the pavement is acquiring strength.

In the fall of 1914 there was constructed in the village of Lyons, Ill., about 8,500 sq. yd. of concrete pavement. About 4,450 ft. of this pavement included two car tracks with a devil strip and a 12-in. strip of concrete outside of the outer rails. The pavement was 11 in. thick between rails and 7 in. thick between tracks. Two-course construction was followed, the top or wearing course being 2 in. thick, calling for one part Portland cement and two parts aggregate, the latter consisting of two parts sand and three parts of granite chips ranging from ¼ in. to ½ in. in size. The base consisted of a 1:2½:5 mixture in which a clean, hard, crushed limestone ranging from ¼ in. to 1½ in. in size formed the coarse aggregate. A machine mixer delivering concrete by means of a spout (Fig. 2) was used on this work. Crown between rails and in the devil strip was obtained by the use of a template resting on the rails while striking off the concrete, and wooden hand floats were used for finishing.

Transverse joints 50 ft. apart were installed by using Baker plates and ⅜-in. Carey Elastite. An inspection of this work showed that many of these joints were low and uneven, which probably was a result of neglect properly to adjust the plates in the installing device and to finish even with the top of the plates. Finishing with a split hand float would have in part compensated for this. A longitudinal joint was placed at the tie ends and formed by two Baker plates, one was placed in the street pavement when it was laid and the other was placed with the 12-in. strip along the rails. Between these two plates a ⅜-in. Elastite expansion joint was installed. As the plate in the street pavement proper was sometimes placed too low and again too high, the contractor found it impossible to finish a neat joint. The only method of holding the inner plate up to the plate in the street pavement proper and against it was by braces set between rails and plate. This often required such a firm setting of braces that the track was thrown out of line. If any defects occur in this track construction later they are likely to consist of transverse cracks in the pavement between the rails at the rail joints and over tie rods owing to the nature of the track construction, which the paving contractor, of course, could not remedy. Rigid rail joints were not always secured in the track and cracks may later develop at these. Old rails and old ties were used and these will not give the desired results.

Hamilton Section C. E. A. is Active

The Hamilton Cataract Power, Light & Traction Company Section of the C. E. A. held their monthly meeting in their rooms, Terminal Station, on the evening of November 15, a very large number of members and friends being present. Mr. L. W. Pratt, president, occupied the chair. The object of this meeting was the furthering of the Safety First movement, the program consisting of a paper on "Accident Prevention," written by Mr. J. B. Douglas, and presented by Mr. Alan Sullivan, secretary of the C. E. A. This was supplemented by a moving picture film supplied by the Ontario Safety First League. Mr. E. I. Sifton, of the Hamilton Safety First League, also gave a short review of the results of the League's endeavors in that city.

An interesting feature of the meeting was a presentation by Mr. E. P. Coleman, general manager of the company, to Mr. Wallace M. Baker. The presentation consisted of the Royal Humane Association medal for bravery, conferred on Mr. Baker for saving the life of a fellow-workman. On August 8th of the present year Messrs. Hurd and Baker were at work on the top of a fifty-foot pole, when Mr. Hurd fell across a live primary circuit. With great presence of mind Mr. Baker pushed him from the line, at great risk of receiving a shock on his own part, and then, leaning over the top of the pole, caught him by the foot as he fell through, and held him until he could be taken to the ground.

The Dealer and Contractor

A Code of Lighting Applicable to Factories, Mills and other work places—Valuable Information for Engineers, Central Stations and Electrical Contractors

A specially appointed committee of the Illuminating Engineering Society of the United States has recently prepared and submitted to the Society a code for lighting of factories, mills, and other work-places. This work has been carried out with a view to presenting authoritative information to legislative bodies, factory boards, public service commissions, and others who may be interested in the enactments, rules, and regulations necessary for better lighting. The code is intended as an aid to industrial commissions and other similar bodies which may take up the question of legislation as related to factory and mill lighting, but it will also be found of great value to the industries themselves as a practical working guide in individual efforts to improve lighting conditions. In the present and following issues of the Electrical News different phases of the lighting of factories and mills will be treated, as outlined in this code of lighting.

Article I. Daylight.—All buildings hereafter constructed must be provided with adequate window area. Awnings, window shades, diffusive or refractive glasses must be used for the purpose of improving daylight conditions or for the avoidance of excessive brilliancy wherever they are essential to these ends.

The windows, skylights, saw-tooth or other roof lighting constructions, are to be arranged with reasonably uniform bays, and the daylight openings shall be so designed and proportioned that at the darkest part of any work space, when normal exterior daylight conditions obtain, there shall be available at least a minimum intensity equal to three times the minimum intensities given in Article V for artificial light.

(Note: The intensity requirements for daylight are higher than those for artificial light because the physical condition of the eye during the daytime is usually such as to require a higher intensity of natural light for satisfactory vision than is required at night under ordinary well designed lighting systems).

Article II. Old buildings at present constructed and not having adequate window area, must be provided with adequate artificial light according to the following articles, so as to supplement the natural light during normal daylight hours.

Article III. All buildings, whether old or hereafter constructed, must be provided during those hours of work when natural light is insufficient or not available, with adequate artificial light according to the following articles.

Article IV. Adequate intensity of the light must be provided for each class of work, both on a horizontal plane as well as on a vertical plane passing through the work, according to Article V. In all cases, however, glare on working surfaces is to be avoided as it tends to reduce the visual efficiency of the workmen and to increase the likelihood of accidents.

Article V. Artificial Light; Intensity Required.—The average illumination intensity throughout any month actually measurable in foot-candles on a horizontal plane through the work is to conform to the following table Uncertain cases which arise as to how to classify given manufacturing operations are to be left to the judgment of a lighting expert.

Class of work	Minimum foot-candles intensity	Desirable foot-candle intensity
Storage, passageways, stairways, and the like..	0.25	0.25– 0.5
Rough manufacturing and other operations....	1.25	1.25– 2.5
Fine manufacturing and other operations......	3.50	3.5 – 6.0
Special cases of fine work....................	—	10.0 –15.0

Where operations are performed on the sides of the work in hand, they shall be classified according to this table, and if the illumination is furnished from an overhead system, it shall preferably be **not less than 50 per cent.** of the foregoing values, when measured on a vertical surface. If the illumination is furnished by an individual lamp or by lamps close to the work, the intensity shall conform to the minimum or desirable intensities required in the foregoing table.

(Note: As a guide to inspectors and others, it may be stated that with modern lamps roughly 1 candlepower per square foot produces an effective illumination of 3 foot-candles when the lamps are arranged according to the uniformly distributed overhead system, with mounting heights ranging from 12 to 16 ft. above the floor, and when the light is directed from said lamps to the work in an efficient manner. A rough idea may thus be secured of the candlepower per square foot necessary to conform to the foregoing table of intensities by taking one third of the intensity values given in the foregoing table).

Thus for fine manufacturing and other operations, the minimum foot-candle intensity is 3.5, which is approximately equal to 1.2 candlepower per square foot. The use of a portable photometer or illuminometer, however, is recommended for the determination of existing systems and all uncertain cases are finally to be established by these instruments.

Article VI. Lamps and machinery jointly, are to be so arranged as to avoid the casting of shadows over belts and other obstructions on important parts of the work, and the distribution of light from the lamps should be such as to avoid sharp contrasts of light and shade on the work.

Article VII. Inspection and regular maintenance of all lighting systems is required in spaces where work is being conducted, and in no case must the lighting devices, whether windows, lamps or auxiliaries such as globes and reflectors, be allowed to deteriorate, due either to dirt accumulations or to burned-out lamps, more than 20 per cent. below the minimum intensity values required by Article V.

Article VIII. Roadways, yards and places not usually frequented must either be provided by illumination during

working hours when natural light is absent or partly absent, to make them safe against accident to employees traversing or engaged in such places, or a convenient control or controls must be placed at the entrance to basements, stock rooms, and the like, so that a person on entering can readily turn on the lamps beforehand.

Article IX. Stairways and passageways must be provided with lamps and reflectors or shades carefully located so as to shed their light generally over the entire space or spaces involved, and in sufficient quantity to make the stairways and passages safe against accident to employees traversing or engaged in such places For intensities see Article V.

Article X. Each working space is preferably to be illuminated by lamps mounted overhead according to the system of general lighting, in preference to individual lighting. The overhead method of lighting, besides possessing many other advantages, also tends to reduce dark spots throughout the floor area, a feature usually objectionable with the use of individual lamps. This particular Article is not an absolute requirement, but a suggestion enforceable at the discretion of a lighting expert.

Article XI. Auxiliary lighting should be provided in all large work spaces, such lamps to be in operation simultaneously with the regular lighting system, so as to be available in case the latter should become temporarily deranged.

EXPLANATORY RULES

The foregoing articles are supplemented by the following rules, which will aid in the observance of the requirements contained in the articles; tend to reduce eye trouble and accidents; and help in the securing of favorable results in planning lighting systems.

1. Lamps should be equipped with reflectors or shades for minimizing glare and economizing light. Bare lamps should not be used except in rare cases and then only when out of the line of vision.

2. As a general plan, mount the lamps high and out of the ordinary line of vision.

3. Although the types of reflectors and shades, and reflector and shade holders or fitters on the market are numerous, it is recommended that the holder or fitter, as well as the reflector or shade be selected with reference to placing the light source at the proper point in the reflector or shade so as to eliminate glare, due to exposure of the light source, and also for the purpose of directing the light from the lamp effectively to the work, that is, for obtaining a distribution of light which meets the desired requirements.

4. Light thrown vertically downward is not the only important component of the resulting illumination. The sides of the machinery, machine tools and work, as well as horizontal surfaces often require good light.

5. Control few lamps in each group so that lamps not needed may be turned off conveniently.

6. Keep windows, lamps and reflectors clean since large losses of light result from the accumulations of dust and dirt.

7. Provide a maintenance department if the shop is large enough to warrant it, so that all the items associated with the upkeep of the lighting system may be cared for systematically.

8. Keep ceilings and upper portions of walls a light color for the purpose of rendering both natural and artificial lighting more efficient and better diffused. The lower portions of walls should be a color which is restful to the eyes, preferably a medium tint, typified by the tint known as factory green, or a rather dark shade of yellow. Other medium tones are also available.

EXPLANATORY NOTES

Section I. Daylight

Adequate daylight facilities through large window areas together with light cheerful surroundings, are highly desirable and necessary features in every work place, and they should be supplied through the necessary channels not only from the humane standpoint, but also from the point of view of maximum plant efficiency.

Importance of Daylight.—The unusual attention to gas and electric lighting in factories, mills and other work places during the past few years; the perfection of various lamps and auxiliaries by means of which an improved quality and quantity of lighting effects are obtained; and the care which has been devoted to increasing the efficiency in various industrial operations;—all go to emphasize the many advantages and economies that result from suitable and adequate window space as a means for daylight in the proper quantities and in the right directions during those portions of the day when it is available.

Three Considerations.—Three important considerations of any lighting method are sufficiency, continuity and diffusion. With respect to the daylight illumination of interiors, sufficiency demands adequate window area; continuity requires (a) large enough window area for use on reasonably dark days, (b) means for reducing the illumination when excessive due to direct sunshine, and (c) supplementary lighting equipment for use on particularly dark days and especially towards the close of winter days; diffusion demands interior decorations that are as light in color as practicable for ceilings and upper portions of walls, and of a dull or mat finish in order that the light which enters the windows or that which is produced by lamps may not be absorbed and lost on the first object that it strikes, but that it may be returned by reflection and thus be used over and over again. Diffusion also requires that the various sources of light, whether windows, skylight or lamps, be well distributed about the space to be lighted. Light colored surroundings as here suggested result in marked economy, but their main object is perhaps not so much economy as to obtain a result that will be satisfactory to the human eye.

(To be continued)

Flat Rate for Long Hour Customers

The Toronto Electric Light Company have just issued a new schedule of rates which will be optional with commercial users of electric light. This rate is also applicable to consumers using the company's d.c. storage battery reserve service. The rate does not apply to power or to residence lighting. The one condition is that the consumer who uses this flat rate must not be making use of any other source of electric energy for any purpose whatever. The new rate is a flat one, so that it is immaterial to the consumer whether the lights burn one hour or twenty-four hours a day. The rate is four-tenths of a cent per watt per month for the first thousand watts connected, and two-tenths of a cent per watt per month for all connected load above one thousand watts; the usual discount of ten per cent. is allowed. Provision is made for as frequent visits by the company's inspector as shall be deemed necessary by the company, and a condition is also incorporated in the agreement that if extra loads shall be added by the consumer without notice he pays for the larger amount dating from the beginning of the last payment period. It is evident that this flat rate will be chiefly of interest to those store-keepers and others who prefer to use their lights during long hours, and should give

a very considerable impetus to window and better store illumination.

Winnipeg Jovians Make Presentation to Late Secretary

The last Jovian League luncheon was held on Wednesday, Nov. 24, at the St. Regis Hotel, Winnipeg. Over 60 people sat down to a fine luncheon at which many notable business men of Winnipeg were present. President Madden, of the C. G E. Co., made an interesting address, after which he called upon Mr. H. W. Billing, of the Northern Electric Company, as president of the Jovian League last year, to make a presentation to Mr. W. E. Skinner, late secretary-treasurer of the Jovian League at Winnipeg, of a beautiful mahogany time-piece. A bronze plate at the foot of the clock bore the following inscription:—

Presented to
William E. Skinner
By Members of the Winnipeg Jovian League
For the efficient manner in which he conducted the office of
Sec.-Treas. of the League. Oct. 13th, 1915.

Mr. Billing made a fine speech in which he praised the active manner in which Mr. Skinner had held the members together and had brought the association to such a high pitch of efficiency. In fact the Jovian League was well known in Winnipeg to be one of the finest organizations of business men outside of the Grain Exchange. Much of this, according to Mr. Billing, is directly due to Mr. Skinner. Mr. Skinner responded in his usual happy manner. This presentation was to have been made a month ago, but owing to the fact that Mr. Skinner had been called to Edmonton to report on a power agreement for that city, it had necessarily to be postponed until this luncheon.

The Rev. J. W. Hindley was the special speaker at this luncheon. Mr. Hindley was formerly Mayor of Spokane, Wash., and has had, accordingly, great experience in civic matters, particularly matters dealing with public utilities. The theme of Mr. Hindley's address dealt with the Sentiment Problem in Social Service. He suggested that the electrical men—the Jovians—should talk less power and light outside of the office—they should leave the keys at the office and forget business when they got home. "Many large institutions, such as hospitals, boys' homes, etc., were more in need of men than of money." Therefore, why should not the electrical men broaden the sphere of their usefulness and give their time to the bringing up of some boy who would otherwise be of no use to the world. In Canada, Mr. Hindley went on to say, there were thousands of boys who had no means of helping themselves, and who would otherwise remain ignorant, who could be turned into good citizens by a little help from such an association of men. This would make different men of many who would then see of "the charm of Life" in being able to help in a good work. A vote of thanks was moved to Mr. Hindley by Mr. W. G. Chace, chief engineer of the Greater Winnipeg Water Scheme.

Vice-president Smith made an interesting announcement regarding the forthcoming bonspiel which the Jovian League members were to participate in. It is anticipated that a bonspiel similar to that held last year will be held shortly.

Mr. Crapper Leaves or Simcoe Abandons Wiring Scheme

Acting under instructions from Chief Engineer Gaby, of the Hydro-Electric Power Commission of Ontario, Mr. H. F. Strickland, chief electrical inspector of the Electrical Inspection Department of the Commission, advises that arrangements are being made to replace Mr. Crapper, the electrical inspector of this department in Simcoe Town, by another inspector unless the Simcoe Commission decide to abandon the wiring campaign which is under consideration.

In a recent issue of the Electrical News it was pointed out that Mr. Crapper was holding the dual position of superintendent of the local Simcoe Commission (who according to their own advertisement were prepared to engage in the house-wiring business) and electrical inspector for the town. Mr. Strickland's statement may be taken as sufficient guarantee that this condition is being rectified. Mr. Strickland points out that there is no doubt that the Commission will not approve or permit the office of inspector being held by any man connected with the wiring business in any way. We are pleased to learn that, in so far as the dual position held by Mr. Crapper in Simcoe has been the cause of considerable friction, this matter has now been cleared off the boards. We hope the Ontario Commission will lose no time in clearing up, in like manner, the dispute regarding the remaining part of our contention—namely, that the Ontario Commission are not justified in engaging, through any municipality, in the wiring business, in opposition to the legitimate electrical contractor.

St. John Electrical Contractors Organize

The electrical contractors of St. John, N. B., held a meeting during the past week at Bonds' Restaurant, and decided to form an association. At this meeting Mr. H. A. Knox, of the Knox Electric Company, was elected chairman, and Mr. S. C. Webb, of Hiram Webb & Son, was elected secretary. It is hoped that the Association will be able to enlist the co-operation of all the local contractors, of which more than fifty per cent. were present at the organization meeting. We understand, also, it is the intention to work towards the appointment of an inspector.

The new association have not as yet decided on the exact form their constitution and rules will take, and correspondence with other associations is invited, with a view to obtaining their co-operation.

Dissolving Partnership

We are advised that J. W. Moncur and E. S. Cook, conducting an electric merchandising business under the firm name of Moncur & Cook, Hamilton, have dissolved partnership. Mr. Moncur will continue the business under the same firm name.

Pelton Water Wheels

The Pelton Water Wheel Company have just issued a little booklet in Spanish, Portuguese, and English which is intended to direct the attention of machinery users to the possibility of Pelton drive for every class of apparatus; also to more particularly direct the attention of people living in remote districts, where electrical energy is not available, to the possibility of using a small stream for the supply of light, heat, and power through the medium of the Pelton wheel.

N. T. R. Plant in St. Malo

The work of construction on the power plant at the Transcontinental car shops at St. Malo is well advanced. Two steam units, Goldie, McCulloch type, 750 h.p. each will be direct connected to C. G. E., a.c., 585 kw. generators. A third unit of 200 h.p. is also being installed in addition to three 400 h.p. motor-generator units for the supply of direct current for variable speed machines. The electrical equipment is being supplied by the Canadian General Electric Company. Mr. S. Darnbrough is engineer in charge of the work of construction. The installation of wiring is being made by the contracting firm of Goulet & Belanger.

What is New in Electrical Equipment

Rogers Tree Insulator

Where overhead telephone and electric light lines pass through residence districts in which shade trees abound, much care is necessary to avoid damage to the trees, else the ill will of the property owners be incurred. If the line rubs directly against the tree, the insulation is quickly worn off and a ground established through the moist branches of the tree. This not only damages the tree, but constitutes a hazard to children or other persons who may come in contach with the tree, besides being the cause of wasteful leakage currents.

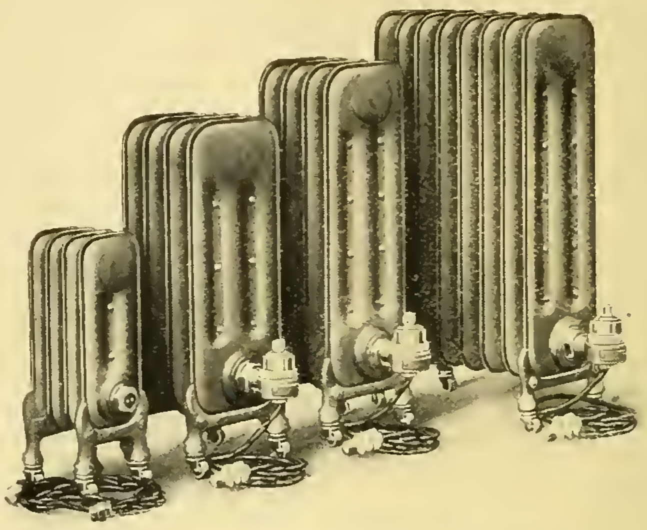
These difficulties are overcome by the use of an effective tree insulator. The Rogers tree insulator is a simple device that can be quickly applied to the line where needed. It consists of a strong, split metal sleeve into the ends of which when assembled there are put split porcelain bushings. A clamp at each end holds the parts firmly together. The bushings serve both to insulate and centre the wire in

the sleeve. The latter is well galvanized to protect it from the elements. It takes all of the rubbing of the tree branches or trunk and thoroughly protects the line from contact with the tree.

Rogers tree insulators are made for five sizes of wire from No. 8 to No. 0 and they are furnished in various lengths from one to six feet. They are manufactured by the Frank Ridlon Company, 158 Summer Street, Boston, Mass.

Lee Electric Radiators

The marked advantages of electric heating due to its safety, convenience, absence of air contamination, and ability to apply it where most required, are bringing about its steadily increasing use, particularly in places where it is possible to obtain comparatively low rates. In the case of rooms where no heating equipment at all is provided, a condition frequently found in sun parlors, ticket and cashiers' booths, and so on, or for auxiliary heating when the regular system may be unequal to some sudden demand made upon it, the electric radiator is proving itself both economical and effective. The radiators illustrated herewith are being manufactured by the Lee Electric Radiator Company of Chicago, who have developed a line of complete self-contained units consuming respectively 200, 500, 750, and 1,000 watts. The principle involved in the construction of these units is that of an open resistance coil submerged in a circulating, non-corroding, non-freezing, insulating liquid, the



Several sizes of Lee Electric Radiators.

whole unit being hermetically sealed. It will be seen that these units are mounted on wheels, and may be easily moved from place to place and attached to any lighting socket or wall receptacle. Control of the larger units is by a three-heat switch. This equipment is being marketed in Canada by Messrs. Weiss & Biheller, 21 Richmond Street West, Toronto.

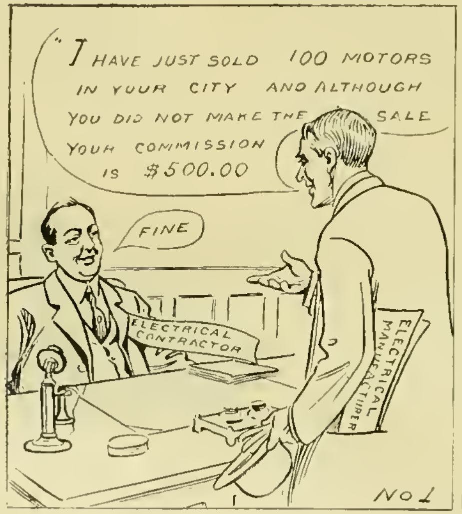
A "Conduit" Wall Hanger

The National Metal Molding Company, manufacturers of electrical conduits and fittings, Pittsburgh., are distributing an attractive wall hanger reproducing in half actual size conduit charts as adopted and recommended by the National Electrical Contractors' Association, and showing sizes of conduit required by the National Code for carrying various sizes of conductors. This hanger is printed on linen, and should be a great convenience for reference purposes in the offices of architects, engineers and electrical contractors. The company advise that they will be glad to furnish these folders on request.

The Pelton Water Wheel Company have just issued a little booklet in Spanish, Portuguese, and English, which is intended to direct the attention of machinery users to the possibility of Pelton drive for every class of apparatus; also to more particularly direct the attention of people living in remote districts, where electrical energy is not available, to the possibility of using a small stream for the supply of light, heat, and power through the medium of the Pelton wheel.

James Roy Weir, manufacturers' agent and electrical supplies, has registered and will carry on business in Montreal, Que.

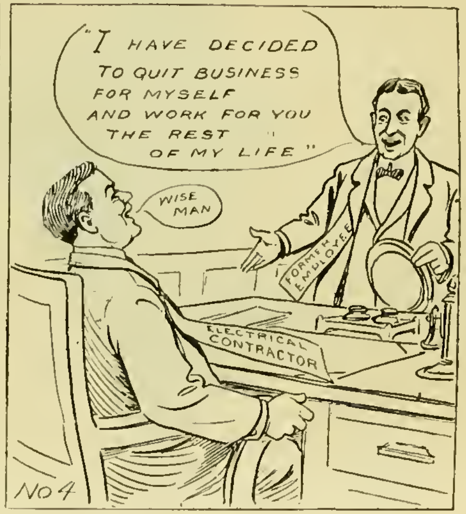
The Electrical Contractor is Happy in his Christmas Dreams



The Electrical Manufacturer calls on the Electrical Contractor.

The Electrical Jobber finally decides to be a jobber only.

The Central Station Interests grant the Retailer's request.



No more competition from the fellow with no office.

The Architect has decided the Electrical Contractor is perfect.

The General Contractor decides to let the Electrical Contractor make a profit.

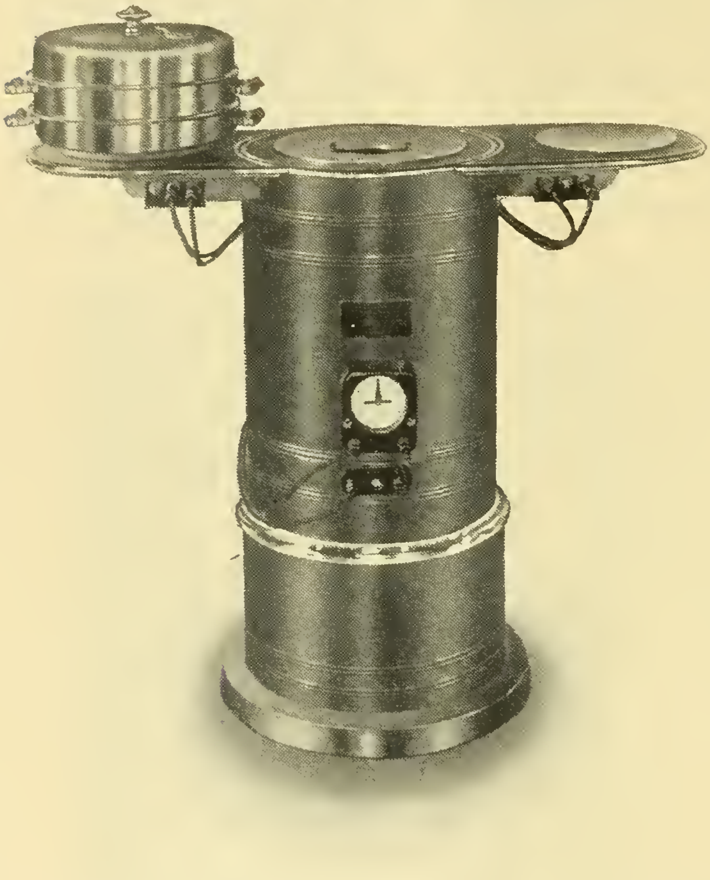
And even a Competitor who lost the job says kind words about him.

Alas! His happiness is of brief duration. Six o'clock and time to get up.

(Courtesy National Electrical Contractor.)

An Economical Cooker

The attention of our readers is asked to the Good Housekeeping Cooker, illustrated herewith, which is designed to do from eighty to ninety per cent. of all the cooking in the kitchen in a cleanly, safe, economical, and hygienic manner. This applies to such things as cereals, vegetables, soups, puddings, meats, etc. The even temperature of the cooker is automatically maintained, which means that current is being used only about 20 to 25 per cent. of the time. As part of the Style "A" cooker there are provided hot plates or disc stoves that may be used for frying, boiling small quantities of water, and the like. There is also provided a portable oven, which can be used for the class



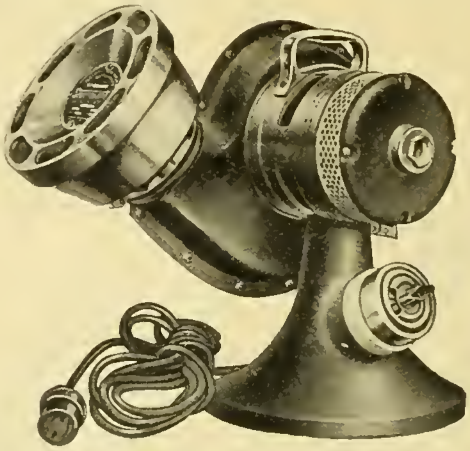
of cooking that requires only a short time and constant watching, such as biscuits, pies, and layer cakes. The same company have developed an electric water heater that automatically controls the temperature and provides hot water at the faucet any hour of the day or night in sufficient quantities to take care of the requirements of an average family. When a predetermined temperature of about 180 deg. has been reached the electricity is turned off automatically, and remains off until the water cools or is replaced, when the electricity is again turned on automatically. Consumption in the water heater unit is up to 2,000 watts. These equipments are being marketed by the Good Housekeeping Cooker Company, Berkeley, Cal.

Jefferson Glass for Big Hotel

The Jefferson Glass Company, Limited, of Toronto, have been awarded the contract for the illuminating glassware for Hamilton's new million-dollar hotel, the Royal Connaught. The contract was awarded by Messrs. Black & Boyd Manufacturing Company, of New York, who have the contract for the lighting fixtures. This means that this magnificent hotel will be entirely equipped with "Made-in-Canada" illuminating glassware.

Sturtevant Heat Blower

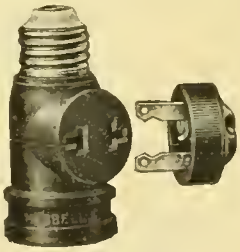
An electric heat blower has just been placed on the market by the B. F. Sturtevant Company of Boston, Mass. This consists of a small motor-driven fan discharging air through heating coils placed in an aluminum casing. The forced circulation makes it possible to deliver a large volume of hot air in a short time. The apparatus is portable,



and can be used in the same way as an ordinary electric fan or the regular cooking utensils in connection with any wiring system. The set is made in five different sizes, delivering air at one, two, or three temperatures, depending on the size. The fan outlet can be turned readily so as to discharge the heated air in any direction. One of these heat blowers is illustrated herewith.

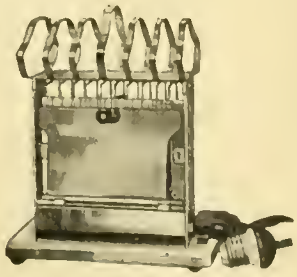
Side Outlet Current Tap

The illustration herewith shows a new composition side outlet current tap being placed on the market by Harvey Hubbell, Inc. In railroad shops, shipbuilding yards, industrial plants, etc., devices of this nature are subject to con-



siderable hard usage and for this class of electrical appliance users this device was primarily designed. A deep groove is provided for the attachment of shade holders. The side outlet is of a T-slot type, permitting the interchange of all non-polarized Hubbell caps.

The Robbins & Myers Company, Springfield, Ohio, advise that their San Francisco office, which is in charge of Mr. C. R. Hunt, has been moved to 701-2 Rialto Building, San Francisco.



Combination toaster and toast-rack just marketed by the Simplex Electric Heating Co. An ideal Christmas gift.

New Books

Examples in Magnetism—by F. E. Austin, B.S., E.E., Hanover, N. H.; price, $1.10. The general scheme of this book is to furnish a guide for students who are beginning the study of electrical engineering. It treats the matter in an elementary manner, though in a mathematical way, so that a knowledge of the principles of mechanics and the elementary laws of physics are necessary. As a book of reference this elementary treatise will be useful to engineers and students.

Alternating Currents, Vol. 1—by F. E. Austin, B.S., E.E., Hanover, N. H.; price $2. A book designed to assist students who are pursuing courses in electrical engineering, to apply fundamental principles in engineering practice. The writer claims, as the result of an experience over a period of many years which has brought him into personal acquaintance with students of engineering from all over the world, that the average student requires a certain amount of guidance in the solution of engineering problems presented to him. It is the design of this book to furnish such guidance, and at the same time lessen in some degree the labor of the teacher. 220 pages; approximately 4½ x 7½ ins.

How to Make a Transformer for Low Pressures—by F. E Austin, B.S., E.E.; price 40c. The transformer here described is a "step-down" transformer to reduce the pressure from 110 volts to about 8 as a minimum for experimental purposes. 17 pages.

Directions for Designing, Making and Operating High Pressure Transformers—by F. E. Austin, B.S., E.E.; price 65c. A companion book to the above, but containing more working directions and useful talks, such as "Loss Due to Hysteresis per Cubic Inch of Iron Core for Various Flux Densities and Frequencies"; "Data Applying to Copper Magnet Wire," etc. Illustrated.

Water Power Engineering (2nd edition)—by Daniel W. Mead, A.S.C.E., Professor of Hydraulics and Sanitary Engineering in the University of Wisconsin; published by the McGraw-Hill Book Company, Inc., New York; price $5 net. In this edition the author has endeavoured to bring the text into accordance with the best modern (1915) practice relating to the theory, investigation, and development of water powers. Various changes, additions, and rearrangements of the first edition, published in 1908, have been made in order to treat the subject more fully and in a more logical manner. Almost every chapter has been revised and extended. Two systems of graphical turbine analysis, published in the first edition, are more simply and completely dealt with, and are believed to be of considerable value, one or other having been adopted by turbine manufacturers and engineers for presenting turbine data. No attempt has been made to treat in detail the subject of turbine design, as the work is intended, not for the turbine designer, but for the student and the engineer who may be called upon to select turbines for water power development. The book also deals with:—streams, their flow measurements and power; pondage and storage; dams, their construction and relation to power stations; the design, testing, relation, and selection of turbine machinery; and the financial and commercial considerations of water power projects. The book is well illustrated; 840 pages; size approximately 6 by 9 ins.

Trade Inquiries

Name and address of enquirers may be obtained on application to the Department of Trade and Commerce, Ottawa.

1205. **Electrical supplies**—A Russian company desires to enter into communication with first-class Canadian factories producing electrical machines and apparatus, insulating materials, steam and naphtha engines and water-turbines, with a view to becoming their agents in Russia.

Trade Publications

Turbines—bulletin entitled "The Terry Turbine" just issued by the Terry Steam Turbine Company, Hartford. Conn.; well illustrated.

Motors—bulletin No. 12, issued by the Advance Electric Company, St. Louis, describing their type W S single-phase, constant-speed motors, in sizes from one-eighth to five horsepower.

Monolite—bulletin issued by the King Foundry Company, St. Joseph, Mo., describing King standards for streets, parks and boulevards. The unit described in this bulletin combines the C. G. E. Novalux unit with the King standard, making a complete unit.

Centrifugal Compressor—folder issued by the Canadian General Electric Company, describing centrifugal compressor set No. 3350—a miniature multistage compressor having three stages.

Mine Suspensions and Clamps—leaflet 3859 issued by the Westinghouse Electric & Mfg. Company describing a number of trolley fittings adapted for mine work.

Motor-Generator Sets—leaflet No. 3742-A issued by the Westinghouse Electric & Mfg. Company, describing motor-generator sets from 2 to 200 kw. capacity, consisting of squirrel cage induction motors and direct current generators.

The Screw with the Square Hole—An interesting pamphlet by the P. L. Robertson Manufacturing Company, Limited, Milton, Ont., describing, with illustrations, the various kinds of wood screws, screw drivers, driver bits, rivets, etc., manufactured by this firm. The screw with the square hole has come to be widely and favorably known among mechanics, general and electrical contractors, particularly, all over the Dominion of Canada.

Electrical Equipment—Catalogue No. 25, issued by the Knapp Electric Novelty Company, New York, illustrating, with descriptions, the products of this company, which include a great variety of miniature, demonstration and experimental electrical equipment.

Constant Current Transformers—Booklet issued by the Canadian General Electric Company, describing, with illustrations, constant current transformers for mazda street lighting.

Lighting Equipment—Booklet No. 77, by the Macbeth-Evans Glass Company, describing, with splendid illustrations, Ajax lighting equipment for nitrogen lamps.

Lighting Handbook—Booklet just issued by the Holophane Works of the General Electric Company. The scope of this booklet is very considerable as is indicated by the title of the various sections as follows: (1) Holophane Service, (2) The Fundamentals of Illumination, (3) How to Install the Products of the Holophane Works, (4) Practical Applications, (5) Photometric Curves, (6) Supplementary Engineering Data, (7) Watts per Square Foot Values for Various Classes of Lighting.

Condensers—Bulletin R, issued by the Mesta Machine Company, Pittsburgh, Pa., describing and illustrating their barometric condensers.

Flashers—Bulletin No. 33, issued by the Reynolds Electric Company, Chicago, describing, with illustrations, Reco flashers, Color Hoods and Motors.

Negotiations for the acquisition of the municipal light plant of Iberville, P. Q., are proceeding between the Southern Canada Power Company and the town, the company having made an offer to take over the business. The town at present supplies the night service, the other portion being in the hands of the St. Johns Electric Light Company, which is controlled by the Southern Canada Power Company.

Current News and Notes

Brockville, Ont.

The Town Council have authorized Town Engineer Bryson to procure an electrically-driven sewage pump, to be installed in connection with the Soldiers' Building at the fair ground.

Burgessville, Ont.

A by-law will be submitted in the near future authorizing an expenditure of $3,500 for an electric distributing system—current to be supplied by the Ontario Commission.

Calgary, Alta.

Commissioner A. G. Graves has reported to the council that he considers it inadvisable to combine the electric light and power departments under one head. The following information covering the organization of the electric department of the city of Calgary, taken from Mr. Graves' report, is of considerable interest:—

After careful consideration I beg to say that the combination of the two departments could be effected, but I cannot see that there would be any advantage accruing to the city from such an arrangement at the present time.

As a matter of fact, the electric light and power departments come under one head, but a division has been made so as to separate the cost of production of energy from that of distribution. Each division is under the control of a man well qualified to look after his respective duties. Both of these branches are working in harmony and co-operating with each other. Further, if an amalgamation of these two divisions were consummated, there would be no reduction in staff.

In the power division, the engineer in charge has supervision of all the machinery, together with charge of the staff in the four sub-stations of the city, and is responsible for the operation of motor generators where used in connection with the street railway and other apparatus.

The electrical engineer of the city is in charge of the distribution, and supervises the operation of maintenance and all the electrical apparatus, together with that of watching the collections and general administration of the system. Therefore, I would recommend that under present conditions the management be left as it is. Should the time arrive when it would appear best to make a change in the present system, I shall not hesitate to make such a recommendation.

Chilliwack, B. C.

The Chilliwack Telephone Company, at their annual meeting, not only re-elected their officers, but granted a bonus of ten per cent. of their yearly salaries to all their employees, to be given on Christmas Eve.

Cookshire, Que.

At the annual meeting of the Westbury Light and Power Company, Cookshire, Que., the question was discussed of extending their lines to several small towns and converting another water power on the Eaton River. This work may be undertaken during the summer of 1916 as the present plant of this company is pretty well loaded and the demand for power is rapidly increasing. The new plant is estimated to cost from $25,000 to $30,000. It is the ambition of the directors to make it the most up-to-date small plant in the province.

Durham, Ont.

The town of Durham is now supplied with hydro-electric current generated at Eugenia Falls.

Granton, Ont.

The electors of Biddolph Township recently carried a by-law authorizing an expenditure of $3,500 on an hydro-electric distributing system which will connect up with the Ontario Hydro System.

Gravenhurst, Ont.

The plant at South Falls, originally built by the municipality of Gravenhurst, on the Muskoka River, has been taken over by the Hydro-Electric Commission of Ontario, and is being remodelled and enlarged. The original unit had a capacity of 600 h.p., and the necessary equipment is now being added to increase the total capacity to about 1,500 h.p. Grading work has already commenced, and contracts have been let to the William Hamilton Company for hydraulic equipment and to the Canadian General Electric Company for electrical equipment.

Humberstone, Ont.

A by-law was recently carried approving a contract with the Hydro-Electric Power Commission of Ontario for a supply of light and power.

Kingston, Ont.

A by-law will be submitted at the January elections authorizing the city council to enter into a contract with the local electric railway company for a five year supply of power at the old rate of 1.2 per kw.h.

Marysville, N. B.

A plant is being installed by the Canadian Cottons, Limited, at Marysville, N. B. The generator equipment will consist of a 62½ kw. unit direct connected to a vertical type engine. This new unit will be used as an auxiliary to two 50-kw. generators at present operated by the company, both for their own requirements and as a means of lighting the residences and streets of the town of Marysville. The distribution system will follow the usual practice of 2,200 volts primary transformed down to 110 volts for street lights and house service. We understand the equipment is not yet purchased.

Montreal, Que.

The officers and directors of the Laurentide Power Company, Limited, have been elected. Mr. J. E. Aldred, head of the Shawinigan Water and Power Company and the Cedars Rapids Manufacturing and Power Company, is the president, and Mr. F. A. Sabbaton, of the Laurentide Company, the vice-president. The other members of the board are: Messrs. Edwin Hanson, C. R. Hosmer, George Chahoon, Jr., J. H. A. Acer, Howard Murray, Julian C. Smith, with Mr. W. F. Robinson secretary treasurer. When a further representative of the Shawinigan company is elected, the Laurentide interests will be represented by five and the Shawinigan by four members of the board.

The Grand Trunk Pacific Telegraph Company has been appointed supervisory agents of telegraphs on the Transcontinental between Moncton and Winnipeg with jurisdiction over all matters appertaining to the construction and maintenance of telegraphs and telephone lines and operation of railroad and commercial telegraphs. The following are the officers: Messrs. H. Hulatt, manager of telegraphs, Montreal; F. T. Caldwell, division superintendent of telegraphs, Winnipeg; Thos. Rodger, supervisor, Montreal.

Some 800 persons in Montreal neglected to make the necessary connections for light and power with the underground conduits constructed on St. Catherine Street and

Bleury Street by the Montreal Electric Service Commission. The city thereupon took legal proceedings for the recovery of the penalty authorized by the city by-law, with the result that every person made the required connections without the necessity of court proceedings, paying the small costs entailed.

According to the annual report of the Marconi Wireless Telegraph Company, submitted at the meeting held in Montreal on December 1, the net profits were $50,020; of that amount $28,956 was absorbed for interest on advances for the year and $15,335 was applied to wiping out the balance of a deficit left over from the preceding year. This left a surplus balance of $5,727. The report states that the company's message traffic was adversely affected by the war, and in that connection the naval authorities are considering compensation.

The Montreal Public Service Corporation and the Montreal Light, Heat and Power Company, with a section of the electrical contractors and supply houses, made special efforts during Prosperity Week to impress upon the public the advantages of the enlarged uses of electricity for domestic purposes. The suitability of electrical appliances for Christmas presents was also pointed out, particularly in view of their permanent nature, their efficiency, and their cleanliness. It was these characteristics which have resulted in the increasing demand for all classes of goods. The desirability of purchasing proper lighting fixtures was insisted on, so that the fixtures may be in keeping with the surroundings, that the light may be properly distributed, not wasted, and not injurious to the sight. Many firms emphasized these points in the local newspapers, while the Montreal Public Service Corporation gave figures showing the economy of using electrical appliances in the home.

The Mount Royal Electrical Supplies Company has registered, headquarters to be in Montreal.

Capt. Paul Sise, general manager and vice-president of the Northern Electric Company, has been appointed adjutant of the 148th Battalion, Montreal.

The Gunn Electric Company, Limited, has been incorporated with head office at Montreal and a capital stock of twenty thousand dollars, to manufacture and deal in electrical, hydraulic, mechanical, and other machinery. The incorporators include E. J. Gunn, W. J. Shaughnessy, and C. G. Heward, all of Montreal.

Mr. Justus Lamothe, in the Superior Court, recently handed down an important judgment in Montreal to the effect that neither the city of Montreal nor the Montreal Light, Heat and Power Company can be held responsible for damages suffered through injuries caused in an accident as a result of poor street lighting or entire absence of light. The judgment says, in part: "Obligations to light the streets is not imposed by the law of the city of Montreal. This as a strict obligation does not exist. The charter simply gives power to the city council to establish a system of lighting and to put it into practice wherever it is judged necessary.

Mount Forest, Ont.

Power is now being supplied in Mount Forest, Ont., from the new plant just placed in operation by the Hydro-Electric Power Commission of Ontario at Eugenia Falls. An efficient street-lighting system has been installed. Power reaches the town at 22,000 volts, 3 phase, and is transformed at the local transforming station to 4,000 volts through three 100 kv.a. transformers supplied by the Canadian General Electric Company.

Peterboro, Ont.

The Hydro-Electric Power Commission of Ontario is said to have advised the acceptance of the offer recently made by Mr. Dickson to supply up to 3,000 h.p. of electric energy at $16 per h.p. delivered at the city limits.

Smiths Falls, Ont.

At a special meeting of the town council of Smiths Falls, Ont., held on November 30, 1915, a five year street lighting contract was awarded the Smiths Falls Electric Power Company. The contract includes the supply of fifty 200 watt nitrogen lamps for the main business streets of the town and two hundred 100 watt nitrogen lamps for the residential districts, all to be arranged on pole bracket fixtures erected by the company at their own expense. The company is allowed nine months for the complete erection of the new system.

St. John, N. B.

The New Brunswick Telephone Company have purchased a three-storey building on Main Street, Woodstock, and during the winter will remodel it preparatory to moving their office and exchange from the present quarters on Queen Street.

Toronto, Ont.

The City of Toronto has awarded the Eugene F. Phillips Electrical Works, Limited, a contract for the supply and installation of eight miles of 250,000 c.m. three conductor paper insulated lead covered cable for a working pressure of 13,200 v. The cable is for the trunk feeders of the Toronto hydro-electric system.

Vancouver, B. C.

The B. C. Electric Railway Company is offering prizes for the best design of an emblem or trade-mark typifying the company's business of supplying transportation, heat, light, and power. The first prize is $50, with a second prize of $25.

West Lorne, Ont.

A by-law will be submitted on December 20th authorizing the town council to enter into the contract with the Hydro-Electric Power Commission of Ontario for a supply of light and power.

Electrical news and
engineering